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Some Recent Improvements in Screw Machines.

In our issue of July 10 we gave an illustrated description of a heavy screw machine, which, as we stated at the time, embodied some new features which we should illustrate more in detail; this we now do on this and the succeeding pages.

The first of the illustrations is an enlarged view of the head, with detail cuts showing the construction of the improved automatic rod feed and the chuck, the enlarged detail view of the former being at the left over the rear spindle bearing. As will be seen, this consists of a cylindrical shaped casing, within which are the two feed rollers shown, the faces of these rollers being of such shape that they readily grasp either round, hexagonal, octagonal or square stock. As will be noted, one of these rollers is placed each side of the hole through the spindle, and is fitted to the end of a short shaft which passes through a bearing, and has at its other end a worm-wheel. These worm-wheels are driven by worms which are on the ends of shafts which pass through the body of the case, and at the other end are provided with small pinions which are in engagement with a ring gear, which is seen in the general view of the head at the rear end of the spindle.

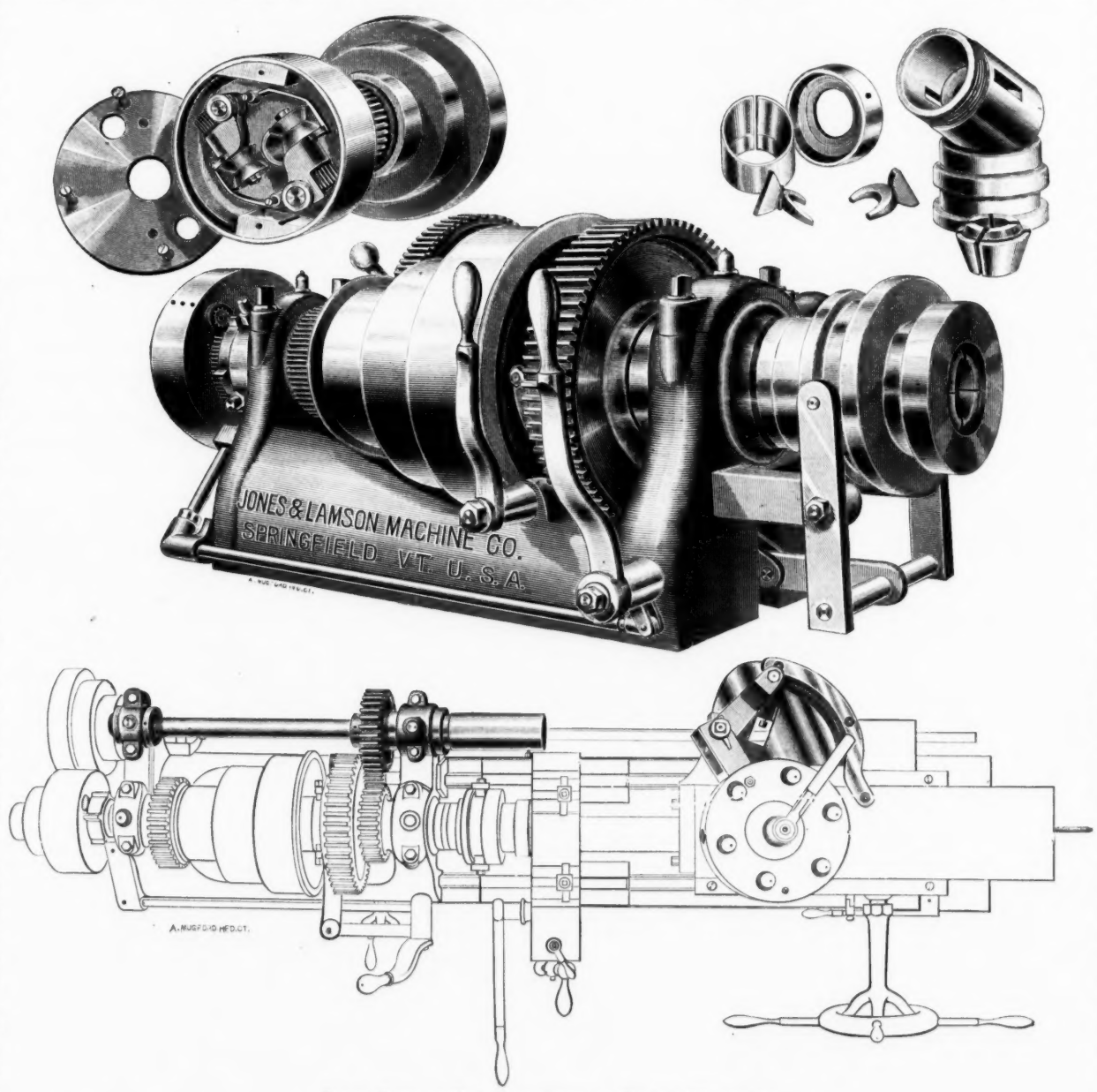
Ordinarily when the spindle is in motion this ring gear revolves with it, and as all parts of the feed mechanism then revolve together, there is no motion of the feed rolls upon their axes; but attached to the ring gear is another ring which has a number of projections on its periphery, with which a stop worked by the larger of the two vertical hand levers can be brought into contact, thereby arresting the motion of the gear, and as the spindle goes on revolving, carrying the small pinions around the gear, they are revolved upon their axes, and, by means of the worm gearing already described, rotate the feed rolls and advance the stock. It will be noticed that there are springs above each roll, which press them to the stock sufficiently to give the feed, and the rolls can be adjusted for different sized stock by screws which project through the case. The rollers, when the stock is not feeding, act to steady it and hold it central with the spindle.

The construction of the chuck will be understood from the details given in the general view, and from those on page 2, which have been made from working drawings. *A* is the body of the chuck which screws onto the spindle in the ordinary way; *B* is a sliding collar, having fixed to its inside surface two wedges, which, as the collar is moved back by the system of levers and connections shown, force the pieces *C* toward the center, and these, acting upon the wedges *D*, force the wedge-shaped collar *E* forward. Inside this collar is the spring collet *F*, which grasps the stock, it being split in the usual manner to provide for opening and closing. It will be noticed that the forward end of the split collet is square where it rests against the inner face of the cap *G*, and as the tendency of the collar *E* is to force it forward against this face when closing it, there is no end motion of the collet whatever during the closing, and as during this operation the feed rolls at the back keep the stock firmly against the stop, the greatest accuracy is obtained in regard to the length of pieces cut off. The movements of the feed and of the chuck are controlled by the same lever, the movements of the different parts being so timed that, when a piece has been completed and cut off, the chuck first opens, releasing the bar, after which, by the continued motion of the hand-lever in the same direction, the feed is thrown into operation, a reverse movement of the lever stopping the feed and then closing the chuck. It will be noted that the only connection between the feed mechanism and the chuck is by the small rod which runs along beside the head, the hole through the spindle being free of all working parts, and therefore admitting the largest possible stock, so that the capacity of the machine is the same, whether these improvements are used or not, so far as the size of stock which can be worked is concerned.

The second engraving on page 1, and Figs. 4, 5 and 6 on pages 2 and 3, represent what is called the "second end attachment," which, when desired, is furnished with this or any turret machine made by this company. The general plan view on page 1 has all the extra parts composing this attachment shaded, the regular parts of the machine being in outline. Where this attachment is used, the back gears are placed beneath the main spindle, and, occupying the place where the back gear shaft usually is put, is a supplementary spindle, which is at the same height and parallel to the main spindle, being driven by means of spur gears with an intermediate, in the same direction, and (unless otherwise ordered) at the same speed. At its forward end is fixed the tool for doing the work, which may be a drill, die, tap, mill, or any tool adapted to the character of the work to be done.

In the turret hole next ahead of the stop is placed a chuck *C* (Figs. 4, 5 and 6), which has a shank the same as any other turret tool, and is put in place and removed in the same way. Pivoted in the body of this chuck is a square frame of steel, the lower part of which is continued on out to form the lever *A*, which carries at its outer extremity a roll which engages with the cams *B* and *B'*. These cams are attached to the turret slide, and therefore move back and forth with the turret. In this square frame are placed the jaws which grasp the work and hold it while being operated upon. The screw seen above these jaws does not turn with them, but is held in the body of the chuck, and is tapped into the upper one of the two jaws, so that when the jaws are turned by the action of the cams the effect is to tighten them upon the work by forcing the upper one down upon it. The height of the screw can be adjusted by a wrench to secure the proper gripping force.

Supposing one end of a piece of work to be finished, the turret is advanced in the usual manner so that the jaws of this chuck pass over the finished portion, but remain open, allowing the work to turn as usual. The piece is then cut off and rests in the jaws, the chuck being then in the position *C* (Fig. 4). Now when the turret slide is drawn back the turret automatically revolves, bringing the chuck into the position *C'*, and the lever into position *A'*. By the swinging of the lever and the gripping jaws, the work has now been brought into line with the supplementary spindle, and at the same time the upper one of the two jaws has been forced down by the screw, firmly gripping the work. The next advance of the turret performs the first operation on a new piece, and at the same time by the same movement the supplementary spindle performs its operation upon the other end of the piece held in the turret chuck. Upon the turret being again brought back, the chuck is swung into its original position by the cam *B'*, while at the same time the jaws open and allow an automatic ejector to push the piece out. This automatic ejector is, however, not used on the larger sized machines, where the weight of the pieces made would make it objectionable to have them thrown down, and it is not shown on the drawings. It will, of course, be seen that on many kinds of work this attachment is calculated to be of great service, as, for instance, in finishing the heads of screws, or threading the ends of studs.



SOME RECENT IMPROVEMENTS IN SCREW MACHINES.

The machine is also furnished with a chasing attachment where it is desired, and all these features are so arranged that all of them can be used without interference one with the other, or any one or more of them can be dispensed with at pleasure. The builders are the Jones & Lamson Machine Company, Springfield, Vermont.

Exhaust Pipe Nozzles and Steam Passages.

The committee of the Master Mechanics' Association, charged with the duty of investigating the above subject, reported at the recent meeting as follows, it being understood, however, that it had not yet completed its investigation of the subject.

"Your committee on the subject of steam pipes, passages and exhaust nozzles, beg leave to report that during the past two years the individual members of the committee have made a number of experiments with a view of finding some foundation to start from on which to determine the size of exhaust nozzles in proportion to other parts of the engine or boiler.

The conditions that must be fulfilled by a successful and desirable nozzle are:

That it must create draught enough on the fire to make steam, and at the same time impose the least possible amount of work on the pistons in the shape of back pressure.

It should be large enough to produce an early uniform blast without lifting or tearing the fire, and be economical in its use of fuel.

After two years of experiment and research your committee has come to the conclusion that, owing to the great diversity in the relative proportions of the cylinders and boilers, together with the difference in the quality of the fuel, that any rule which does not recognize each and all of these factors would be utterly worthless. The quality of fuel is one of the most important factors, and must be recognized. The diameter of the cylinder cannot be taken and the stroke and other proportions ignored.

The size of stack alone, without taking into consideration the size of cylinder, grate and flue area, is manifestly at fault.

The principal question on which the exhaust nozzle practice of the country splits is whether the pipe shall be double or single.

Those using the double pipe claim that in this way only can the exhaust from one cylinder be prevented from adding injurious back pressure on the other, while the advocates of the single nozzle urge that the use of two exits requires that neither of them shall be central, and consequently the exhaust will not produce the maximum effect, while the single exit being in the axis of the stack will produce the maximum effect, and can, in consequence, be made larger and reduce the necessary back pressure.

Your committee regard neither of these opinions as correct without some qualification. We have found that there is very little difference in the back pressure in either plan, and this is entirely a question of design. So true is this that it is impossible to determine, from the card alone, which type of nozzle is used.

Your committee is also of the opinion that the use of the single exit does not insure concentricity of the exhaust steam with stack, and that in very many of the single pipes the steam is not discharged even approximately central.

The greatest part of the experimenting of the committee has been with single pipes, with a view of embodying the results in future engines ordered by their roads. The questions which were to be determined were the total heights of the pipes and the height of the bridge, relative to that of the pipe. Also the relation of the area of each exit at meeting point to the final exit. The first of these questions we have not determined. Starting with the idea that, in order to reduce the effect of the exhaust of one cylinder upon the other, bridge must be carried nearly to the top of pipe, we have found that the height had no perceptible effect in this direction, but the greater the height relative to that of the pipe, the greater was the difficulty in preventing the discharge from crossing in the stack.

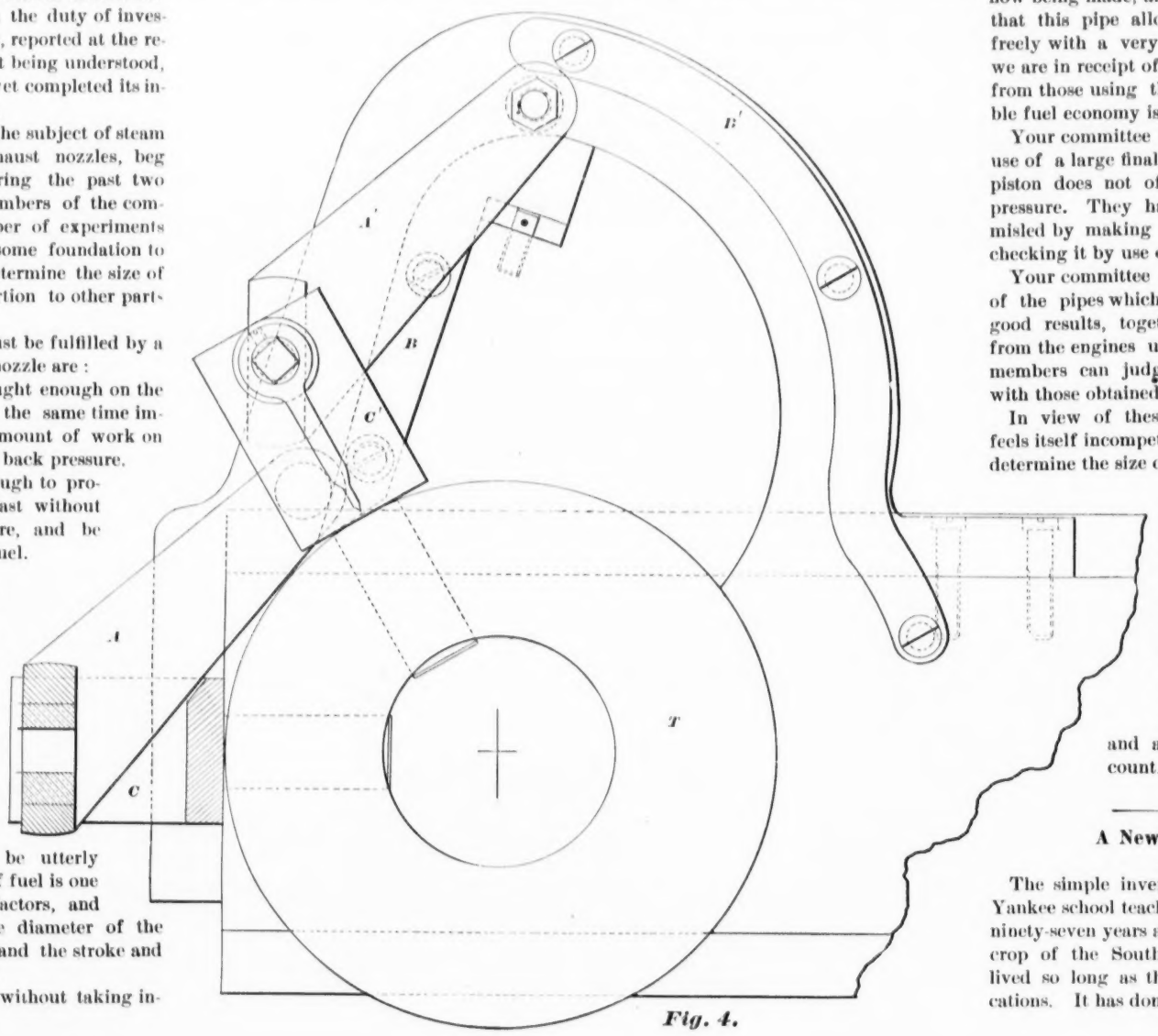


Fig. 4.

Acting on this, your committee has in some instances reduced the height of bridge to much less than half that of pipe, with no increase of back pressure. Your committee is of the opinion that the most vital point in the design is that the area of each of the two pipes where they combine shall in no case exceed that of the final exit, and the indications, so far, are that this area can, with advantage, be made decidedly less than the final one; how much less we do not know.

Your committee, while aware that, in addition to the types of nozzle mentioned, there are various annular ones as well as those in which the discharge is spread after leaving pipe, but as yet we have not been able to test their merits as compared with plain pipes, except in the case of the Smith triple expansion pipe, on which experiments are now being made, and so far we have found that this pipe allows the engines to steam freely with a very large final opening, and we are in receipt of several communications from those using them, in which considerable fuel economy is reported.

Your committee would also state that the use of a large final exit relative to that of piston does not of itself imply low back pressure. They have more than once been misled by making this assumption without checking it by use of indicator.

Your committee submits drawing of one of the pipes which they consider has given good results, together with several cards from the engines using it. From these the members can judge how results compare with those obtained on their own roads.

In view of these facts, your committee feels itself incompetent to advise any plan to determine the size of exhaust nozzle in proportion to any other part of the engine or boiler, and believes that the best possible practice is for each user of locomotives to adopt a nozzle that will make steam freely and fill the other condition named, best determined by an intelligent use of the indicator and a check on the fuel account."

A. W. GIBBS,
J. A. HILL.

A New Cotton Gin.

The simple invention of Eli Whitney, the Yankee school teacher, has stood the test of ninety-seven years and made cotton the great crop of the South. Few inventions have lived so long as this without radical modifications. It has done faithful work, but from an economic standpoint has not satisfied the present age. Inventive genius has tried time and again to improve upon it, and now success is reported as attained, this time also by a Northern genius.

This new machine has just been tested and pronounced a success. It is a compact, simple machine. On top is a hopper which extends across the gin. In this is placed the cotton as it comes from the field. Underneath the hopper is a "picker" to separate

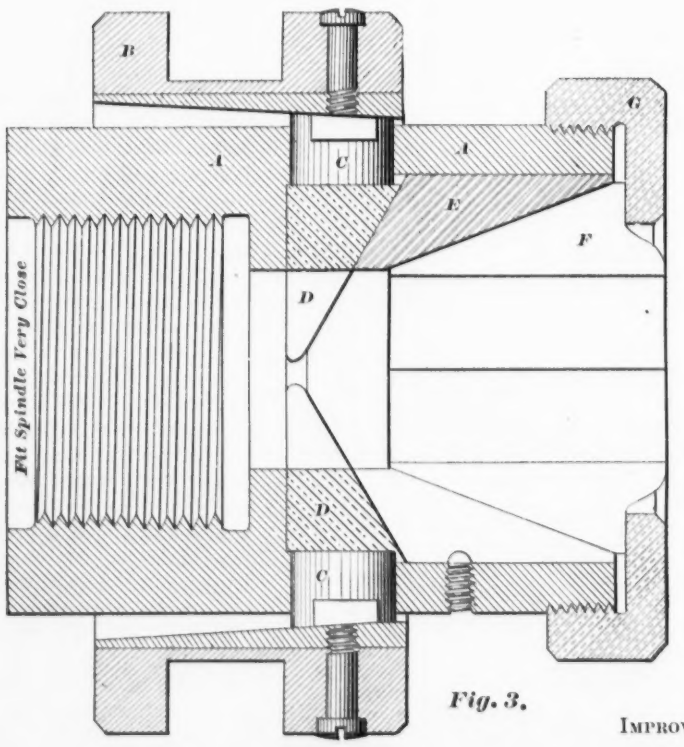


Fig. 3.

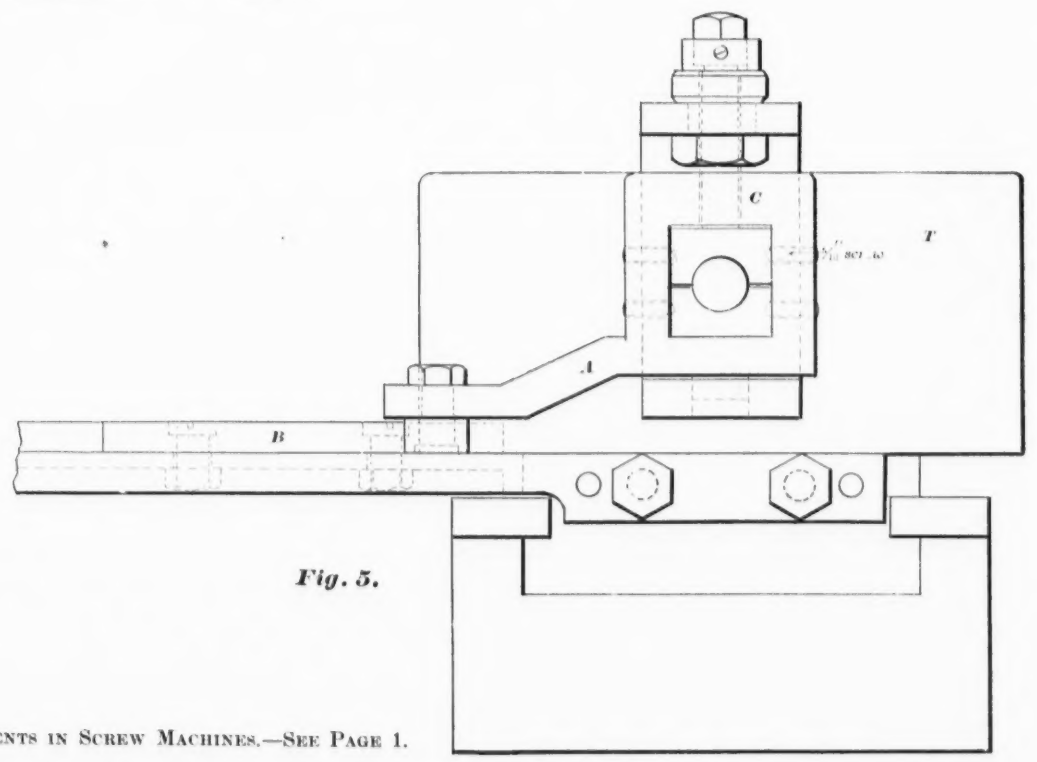


Fig. 5.

IMPROVEMENTS IN SCREW MACHINES.—SEE PAGE 1.

it. The cotton is delivered from these rolls to a drum with ribs, running at a great velocity, which frees the cotton from dirt, sand, and pieces of the leaf. The cotton then drops onto a set of steel rolls, one-half an inch in circumference, which have a play of about six inches. Above this is an "agitator," which turns the seeds around, and in a trice they are separated from the staple. The seed falls into one compartment, and the pure white lint into another. The results are claimed as equal to the best hand work, and every fiber of the lint is saved. It works particularly well with Sea Island and long staple cotton, and, what is particularly to its credit, leaves the seed so free from fiber that no second operation is necessary. If this new gin does the work its friends claim it will, it will be worth an immense amount of money to the South.—*Manufacturers' Record.*

The "Vesuvius" and her Armament.

BY M. W. SEWALL.

SECOND PAPER.

Through the kindness of Mr. Schuyler, such access has been allowed to the detail drawings that we are enabled to show them quite fully. In Fig. 1, *a* is the barrel, *b* is the discharge valve casing, *c* and *c'* are the revolvers containing the projectiles; *a'* is the loading section of the barrel; it is hinged to the discharge valve casing at *b'*, and is lowered into the horizontal or loading position, and raised to the firing position by the double-acting hydraulic ram *d*. The discharge valve casing *b* is the base piece of the gun, so far as it may be said to have one. It locates the gun in the boat, and receives the recoil stress from firing. No movement of recoil is allowed.

The valve casing rests on a bridge of heavy plates and angles extending all the way across the ship, and is firmly riveted to the frames and the keelson. The valve casing has heavy flanges on either side, which rest upon the bridge and are bolted to it; the air conduit extends down between the flanges. These flanges locate the piece, and the bridge receives through them the vertical stress. The horizontal stress is conveyed to the bottom of the ship, and distributed over a considerable length, including 9 or 10 frames, by the forged pieces *f*, which are firmly riveted to the frames by pairs of horizontal angle irons between the vertical members of which the forging is placed, and all three are riveted together. These diagonal ties (one on either side of the valve casing) are bolted and keyed to planed cheeks on the casting; the keys are slightly tapered, so that initial stress can be put upon the ties.

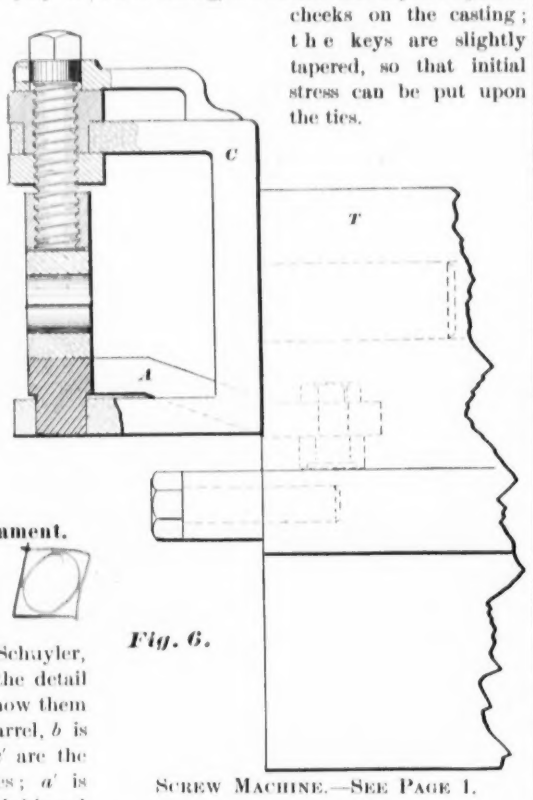


Fig. 6.

SCREW MACHINE.—SEE PAGE 1.

The air conduit leading to the firing reservoir is 12 inches in diameter, and the discharge valve has an equivalent opening into the barrel. The 210 lineal feet of 16 inch diameter tubes mentioned are disposed in 3 lines of about equal length, and extend aft of the gun-room under the boilers. The ends of the 3 lines extend through the bulkhead into the gun-room, and are flanged to the distributing castings. The 210 feet of tubes form one reservoir common to the 3 guns, and it is connected to each by a 12-inch conduit; a stop valve to separate the reservoir into two parts is shown at *l*, Fig. 1. This is for experimental purposes.

The dotted lines at *a''* show the position of the end of loading section when in the loading position, *e* is the loading ram used for loading the projectiles, and also for transferring them from the section *a'* into revolver *c*, and from *c* to *c'* and *vice versa*. The auxiliary valve is shown at *g*, the firing levers at *h*, Fig. 11, and the levers for the loading operations and the interlocking system, are shown in a cluster at *k*, Fig. 1*A*. The levers in Fig. 11 are placed in the conning tower, and are connected to the clusters of levers shown at *h'* in Fig. 1*A*. The projectiles are carried to the gun-room through the barrel. A trough (Fig. 8) is attached temporarily to the muzzle of the gun, the projectile is lowered into it, and a line is attached to each end. The butt is placed nearest the muzzle, and the line is passed through the barrel into the mouth of the discharge valve under a temporary sheave, and out through a hole in the top. Men at each end then take the lines and pass the projectile down until it strikes the face of the discharge valve mouth; they always have it in control by the use of the two lines. When it is all the way down the section is lowered, the line drawn down through the barrel and attached to the arm of the ram, and the projectile is pulled out of the barrel into the revolver. The loading ram has a stroke of about 14′ 6″, but is arranged so that a projectile may be transferred a distance of about 29 feet. It may be seen on a larger scale in Fig. 2. The cylinder (77) is supported between two I beams, which serve as guides for a driving crosshead (71), which receives the operating rod (74), which rod lies directly above the piston rod (73), and parallel to it. The upper rod is carried at its opposite end by a supporting crosshead (66) of an inverted U form, to pass over the cylinder heads; it runs on the same guides as the driving crosshead. There is also an intermediate crosshead (70) of the same character as 66. Fig. 3*A* shows the elevation of the revolver *c'*, with its lever for operating the hydraulic motor by which it is driven. It also shows a cross-section of the guides (68, 69), the hydraulic cylinder, and in elevation the driving crosshead (71).

An arm which extends up through slots in the revolver cells is shown at 76. This arm may be transferred to 75, so that by two motions of the ram piston the projectile is transferred twice the length of the stroke, as before mentioned. On charging the revolvers the projectile is first pulled out of the barrel by the arm when in its present position on the rod (74). It is then taken off, the ram returned, the arm replaced, and the projectile pushed from *c* into *c'*. When it is desired to return the projectile the ram is run all the way ahead, the arm put on at 75, and the ram run back, carrying the projectile with it. The arm is then put at 76, after returning the ram to its forward position, and the projectile is forced into the gun barrel by again reversing the motion of the ram. In firing, all the projectiles in *c* would be fired, and then those in *c'* transferred to *c*.

Each revolver is driven by a separate water motor. These motors are placed on the berth deck, with their shafts vertical and extending down to carry worms, which drive the revolvers directly by worm-wheels on their shafts.

The cast plate, which is shown at 80, is the bearing of the revolver shaft and motor shaft. It is bolted to a skeleton framing, extending from the bottom of the ship to the berth deck, and nearly its full width, sufficient room only being left at the sides for passages past the revolvers.

The handle 86 operates the reverse valve of the motor. It is opened by hand, and is shut off automatically by the movement of the revolver, so that the operator has only to open the valve and the revolver moves one space and stops in the right position for the next projectile to be transferred. This is done by making the notch for the spring-latch of the lever in a moving rim on the rerevolver, and making the closing movement of the handle and motion of the revolver in the same direction. The loading revolver *e* is arranged in the same way. Its operating handle is seen at 23

The hydraulic ram for elevating and depressing the gun is mounted on wrought iron

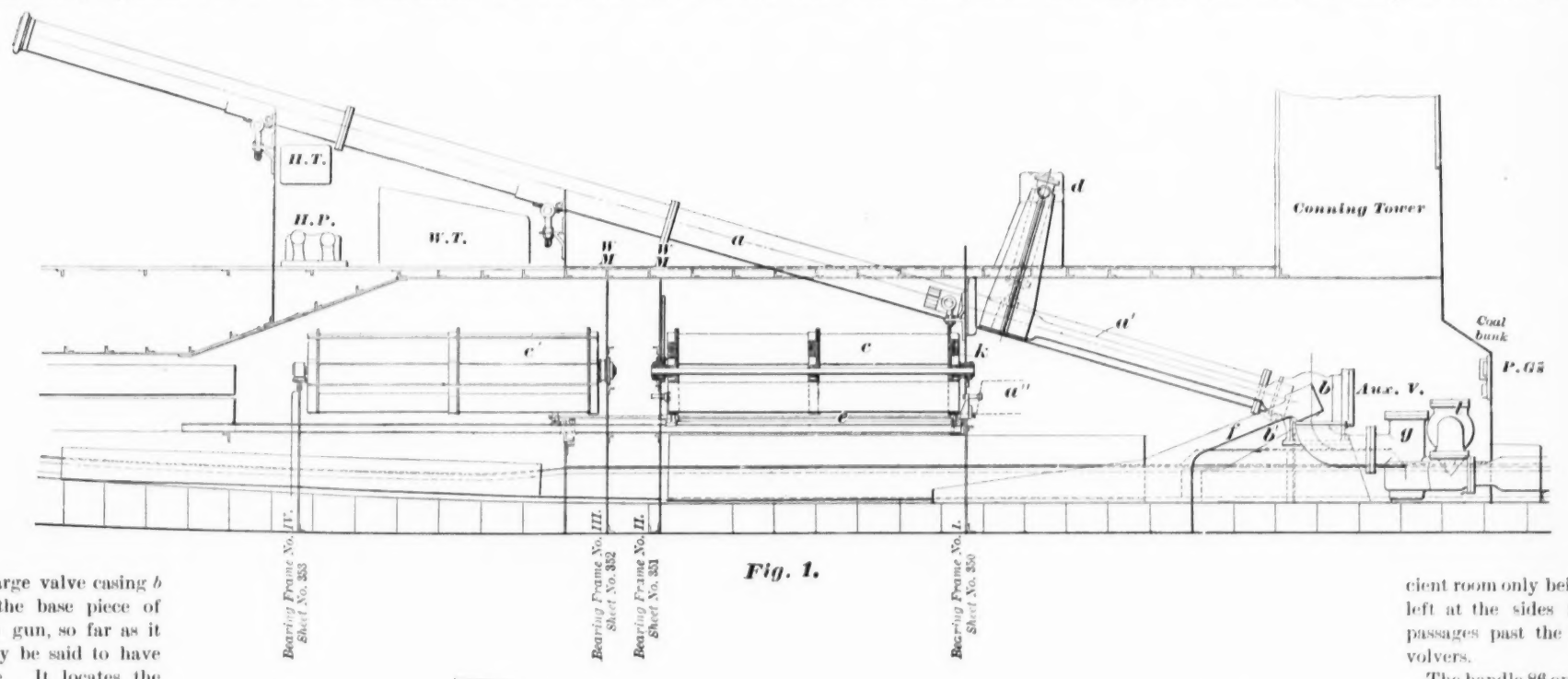


Fig. 1.

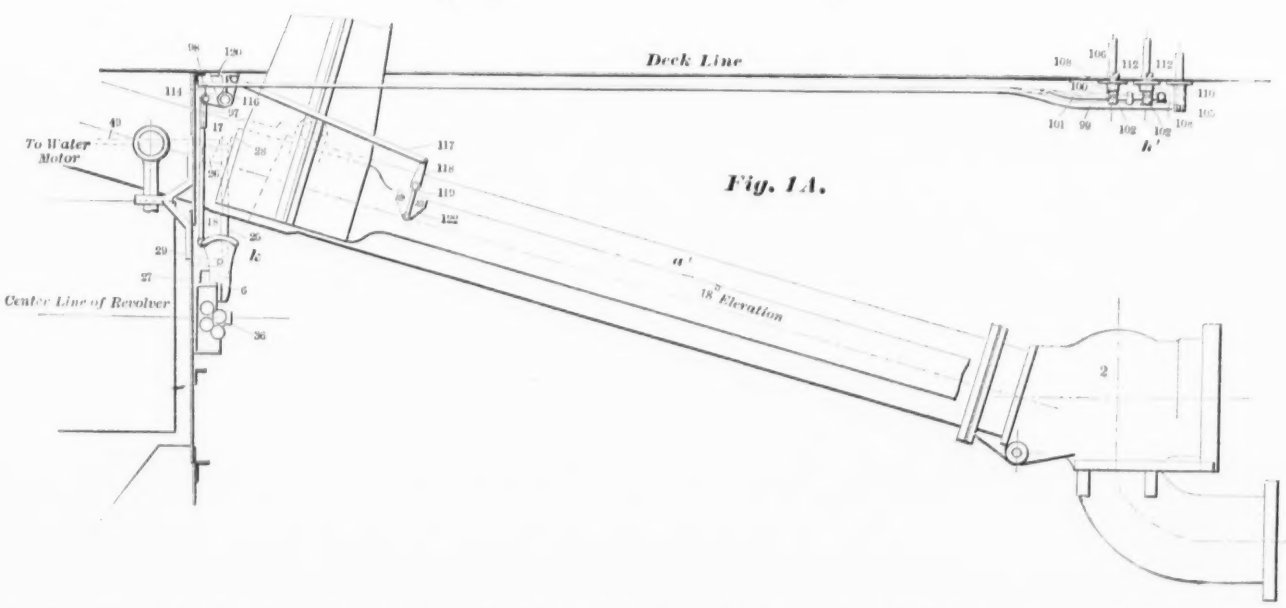


Fig. 1A.

housings, supported on the rear end of the fixed portion of the barrel, and on the tie-bars which attach this part to the firing valve casing. Stop pieces and a V-shaped guide on the meeting parts of the barrel insure the alignment of the loading section of the barrel with the fixed portion when it comes into firing position. To insure the proper loading position, the hydraulic cylinder has been fitted with a stop inside, filling the bore so that the piston practically comes solid against the head at the lower end of the stroke.

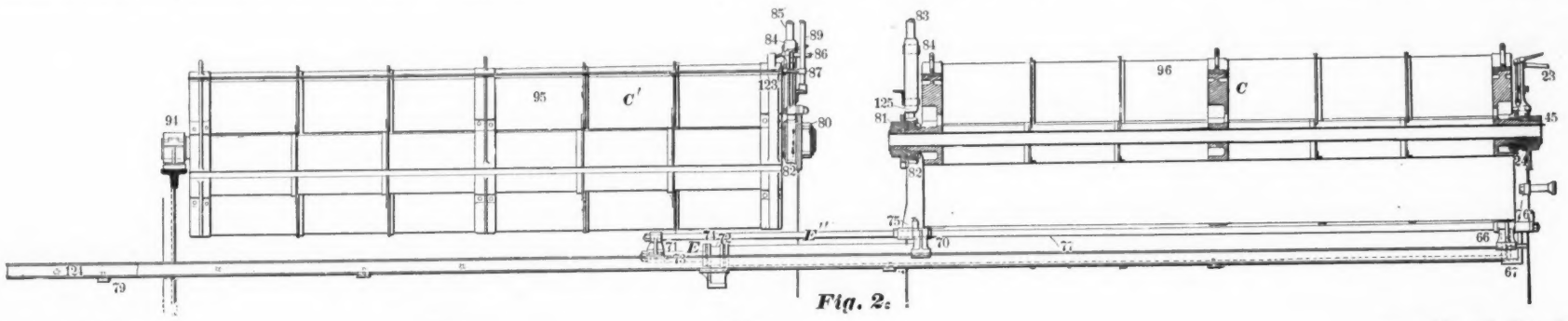


Fig. 2.

Shop Notes.

Mr. Miller F. Moore, of Samuel L. Moore & Sons, Elizabethport, N. J., has recently returned from a trip to Europe, where he has been looking up the matter of shipyard equipment especially.

He has returned feeling very enthusiastic regarding the benefits to be derived from such a trip by any one interested in such an establishment as his is, and is designed to be. While evidently filled with admiration at the way iron and steel shipbuilding is carried on, on the Clyde, he knows no reason why it should not be as well done here, and, so far as his own yard is concerned, things are rapidly being put in shape to do the work as well as is done anywhere, though, of course, not on the most extensive scale. Much of the machinery is already in place, and some contracts being on hand for vessels to be built for private firms, the plant is expected soon to be in operation.

No more favorable location for shipbuilding operations could well be desired than theirs. Mr. Moore says the Arthur Kill at that point is one-third wider than the Clyde, and as it is but a short distance through the Kill Von Kull to New York Bay, and every convenience is at hand for shipment of materials, either by water or rail, it seems not improbable that this may become an important shipbuilding center.

In the shops the principal work on hand at present is on some Straight Line engines of the tandem compound type, and in larger sizes than any yet built at Syracuse. Mr. Knight, who has charge of the tool-room, has been devoting a share of his ingenuity to the devising of tools for the work on these engines, with some very creditable results. Under the guides on these engines are used a number of short posts of cast-iron, cylindrical in form, with a hole passing through the center for a bolt, and turned outside to a uniform size. One end of these pieces is faced off square, while the other is faced at a certain angle, which must accurately correspond to beveled seats formed upon the

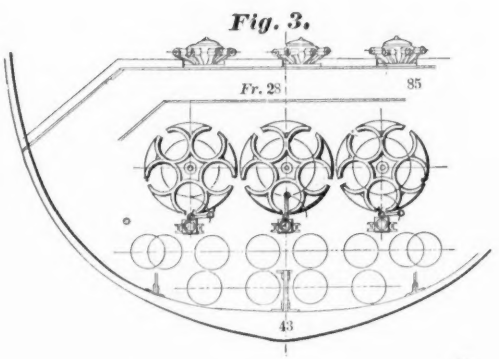


Fig. 3.

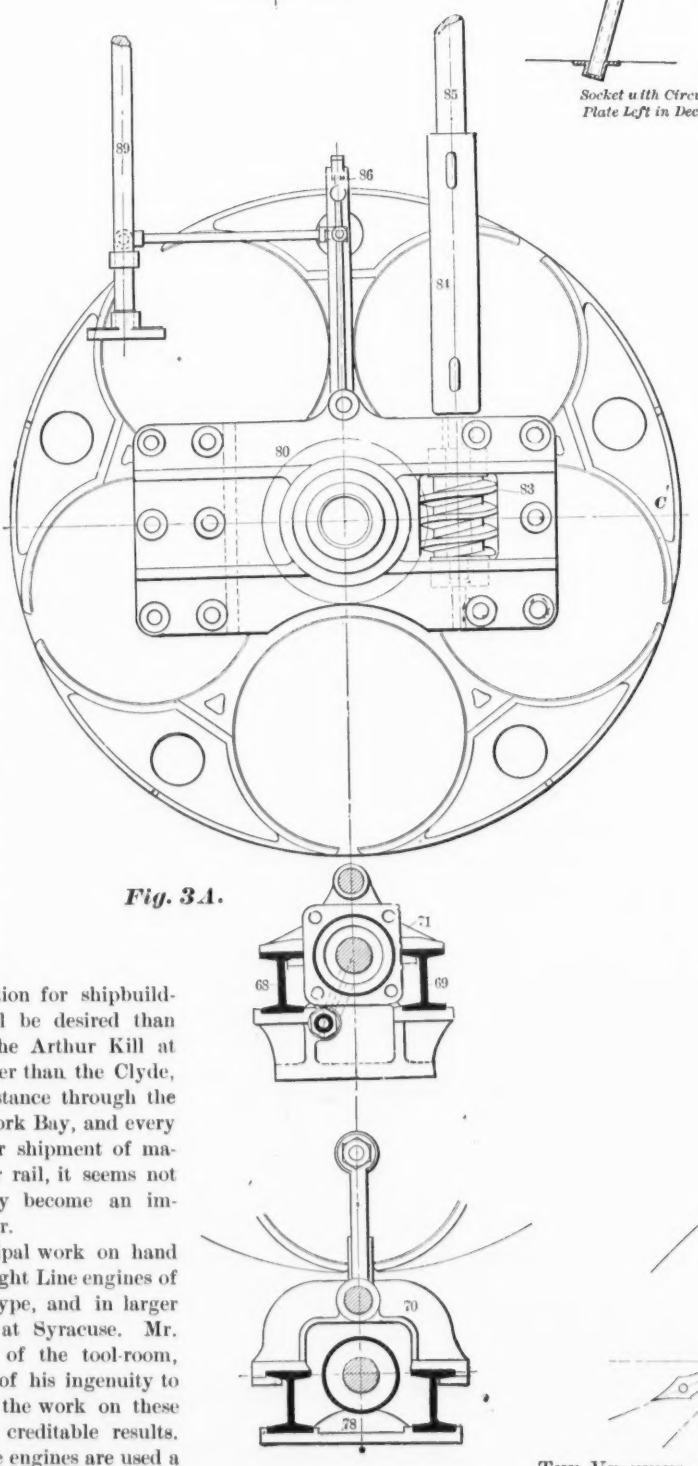


Fig. 3A.

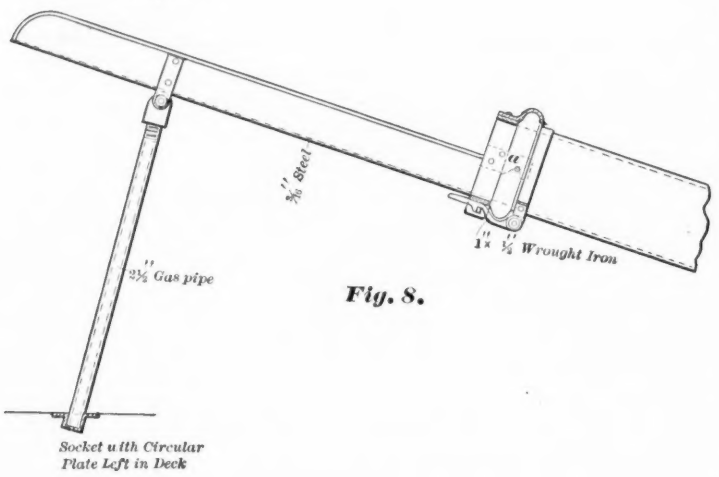


Fig. 8.

Socket with Circular Plate Left in Deck

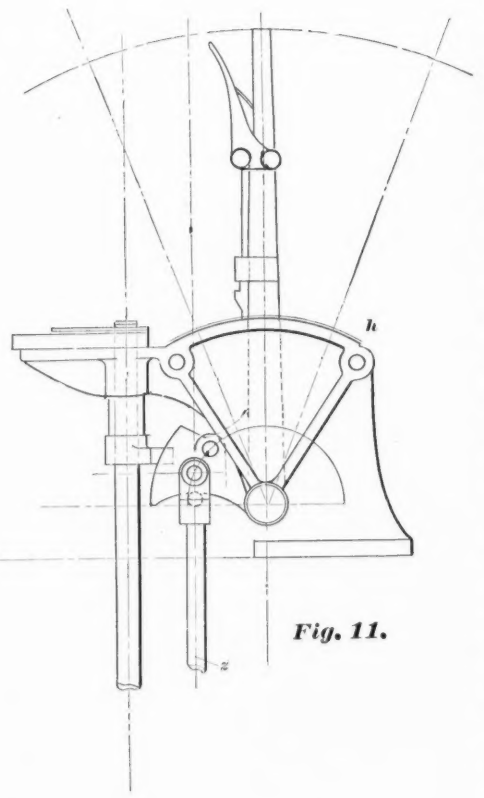


Fig. 11.

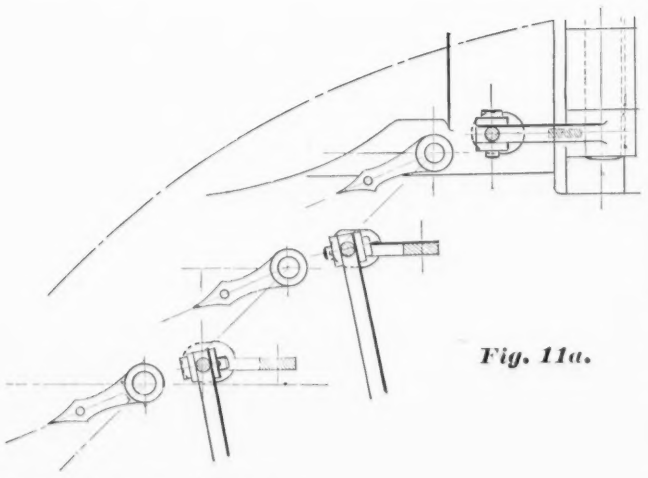


Fig. 11a.

THE VESUVIUS AND HER ARMAMENT.

in a bar, which is put into this chuck, in which it is cut up into lengths, and the ends faced.

The chuck is made to bolt to the faceplate of a lathe, and has in it a hole which appears to the casual observer to be a plain cylindrical one the size of pieces. This hole, however, has been made by first boring such a hole as it appears from the outside to be, viz., a straight, true hole, the size of the pieces. But afterwards the chuck was fixed with its center line at an angle to that of a boring bar, corresponding to the bevel desired on one end of the pieces, and carefully centered so that the cutter started in concentric with the first hole, but instead of going straight through, it cut away one side of the bore at the proper angle, thus making what might be called two holes in one, or a single hole, one side of which is true, while the other is at an angle, or, as a machinist might express it, it wabbles.

Two set-screws are put in, opposite each other, one forcing the bar that is to be cut to one side of the hole, while the other forces it to the opposite side, and, by tightening and loosening these screws alternately, every other cut of the cutting-off tool goes through the bar square, while every alternate one goes through at the proper angle to give the required bevel.

As most of our readers know, one of the peculiar features of Prof. Sweet's engine is the absence of rod packing, in the sense that that term is ordinarily employed—long, solid sleeves of babbitt metal being employed instead, which fit piston and valve rods closely. It is an object, of course, to get the holes through these as straight and smooth as possible, and they are made to standard gauge, not only so that they may afterwards be turned on a standard arbor, but for interchangeability. As some of these holes showed on looking through them a remarkably fine surface, the reamer with which they were finished became an object of interest. It was found to consist of a hardened and ground steel bar, perfectly plain, except that near one end was what might be called a rather broad and flat key-seat, which had been sunk into the bar by a milling cutter, not running out at either end of the bar. The bottom of this key-seat was not parallel, but tapering; that is, one end of it was somewhat deeper than the other, and into it was fitted a piece of steel corresponding to the key, and having formed along either of its exposed corners cutting edges, which were shaped similar to those of an ordinary reamer, ground to size in place and backed off. Passing down through the center of this piece are two small screws, which are tapped into the bar, and serve to secure the cutter in place, the holes in the cutter being slotted, so that, by moving it endwise, the size is adjusted by means of the taper at the bottom. A good deal of grinding of cylindrical work is done here, one of the largest size of Brown & Sharpe universal grinders being among the equipment. Some grinding is done, however,

on work which is too large and heavy for this machine, and is, therefore, done in a large lathe, and in this connection an interesting phenomenon has been observed, which goes to show the sensitiveness, and (where proper conditions are secured) the accuracy of grinding operations as compared with lathe work. Outside the building, and about 150 feet distant, is a drop for breaking up scrap castings, and when grinding is being done in the lathe it is found that this drop cannot be used, for the reason that the jar, though scarcely noticed in connection with the operations going on all around on other machines, seriously interferes with the grinding.

Tools for Brass Work.

BY FRED H. COLVIN.

As there is but little written concerning brass work, and as it is by no means an unimportant branch of the mechanical arts, a few suggestions as to the work, descriptions of tools, etc., may not be unwelcome to the many tool makers engaged on such work, even though we rarely hear anything from them.

The tool maker in a small shop—and this is especially true of a brass shop—has little time to himself to outline an article, even in imagination, and it isn't to be wondered at that he never feels like writing the many "kinks" they all have during the little time he has at home; still some do, as this will testify.

There is scarcely a brass shop running now that has not at least one turret lathe, and the majority have several, varying in size to suit work.

Given a good turret lathe and a good tool maker and you have a combination that will produce an astonishing amount of work, for the tool maker will be continually seeing methods of doing work, forms of tools that will lessen the number of operations, and in many ways help a little at a time to increase the output, with no greater exertion on the part of the turret hands. In this paper, dies and taps for brass work—turret work principally—will be the subject dealt with—though in a modified form, to suit existing conditions, they might be used for any work.

There are several conditions to be considered in the designing and making of these turret dies, and for any tools as well, and these seem to be first cost, durability, and power consumed, the work produced, of course, being of the required standard.

First cost is many times a bar to the general use of a good tool, though it is a seemingly short-sighted policy that makes it a bar when in durability and lessening of power required it far excels the ordinary forms.

Dies for brass usually require more thread left in them to act as a guide than dies for iron, brass being a metal (*i. e.*, ordinary brass castings) that strips the thread without much provocation at times, and the cause can usually be traced to having the die too sharp—too much "lead" or "backing off," as some term it, or too few threads in the die to act as guides.

Several years among such work has developed the forms of dies from the old "split ring" die to the one here described, and what seems to us to be the best adapted for the work of any yet produced.

A solid die for our work was not to be thought of, as the work must be of exact size, and kept to standard gauges, and as dies will wear they must be capable of adjustment.

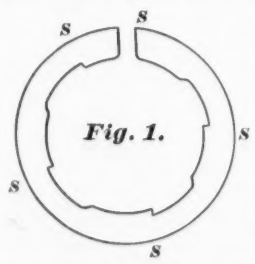


Fig. 1.

The "split ring" die just mentioned was a solid ring turned to fit a holder or collet, and the thread chased; then, after filing in several notches, as shown in Fig. 1, it was split and the adjustment effected by set-screws at different points indicated, the end of the die where cut doing the most work.

This form of die soon gave way to a much better one (Fig. 2) and is shown end view in the holder, a shank on back fitting the turret hole. Fig. 7 will show the form of holder.

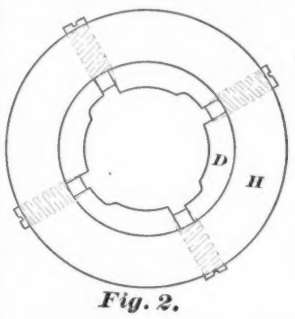


Fig. 2.

A ring of steel is first turned to fit the holder *H*, and then drilled to match the set-screws as shown, but not drilled *through*, just enough to admit the piston and hold it while being bored and threaded. If the holes are drilled through it makes four springs for the thread tool every cut, and a thread tool chasing steel doesn't last any too long. After being chased it is sawed at the screw holes, and a little ground or filed off the back ends, to give room for adjustment, then part of thread cut away for relief so as to lessen friction while cutting. It will be seen that the cone-point screws tend to spread the sections and hold them firmly against the sides and bottom of holder, and adjustment can be made by "lining" behind the sections. If more lead is wanted line behind the cutting end, and if it has too much, the back end can be lined to suit.

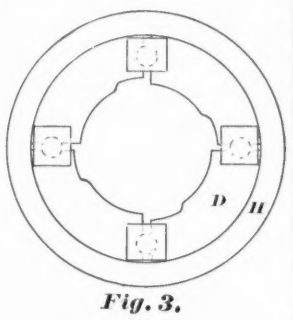


Fig. 3.

This makes a good, substantial die, and as we have some that have been in use five years or more the durability will hardly be questioned; but all our late ones are of an improved design, as the cuts will show in detail. Fig. 3 shows it front view, and the difference from the last will be noted at once, as there are no projecting screws to interfere with any close work. Fig. 4 shows the die ring ready to be put into the holder to be bored and chased, and, as will be seen, has four holes drilled and countersunk for cone-head screws, three of which are shown in place. These are only used while boring and chasing, however.

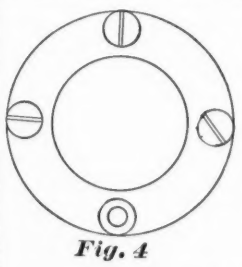


Fig. 4

After this is done they are sawed, as are the others, and the ends filed, as shown in Figs. 5 and 6, for the reception of the binding bolts used in place of the cone-head screws. In Fig. 5 *A* is the leading or cutting corner and *B* the back end of the next section, and in this *A* is filed, as shown more plainly in Fig. 6, while *B* is filed straight across. This is done to leave a square cutting corner for *A*, and the back end of *B* being filed away gives more room for chips. As will be seen, these are filed away at an angle of 45° to receive the binding bolt, filed similarly, as may be seen by referring to Fig. 7, which shows one in place. This also shows the method of fastening, a nut on back being used to draw them taut, and no trouble from slipping has been experienced, so no lock nut has been found necessary.

Fig. 5.

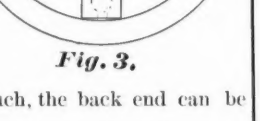


Fig. 6.

Cone-head screws might be used and have them screw into the body of the holder, but for our work we prefer the square-head bolt-filed coning under the head, which performs the same office as the cone-point screws in the form before mentioned. We are using this die in sizes from 1.70 inches with 12 thread to 3. inches with 8 threads to the inch, and use four sections for all sizes. They have worked admirably, take but little power when properly adjusted, and the bolts as shown make a more solid die than the set-screws, beside most of the binding strain being drawn against the solid back of holder, instead of the sides taking all the strain, as is the case with the set-screws in Fig. 2.

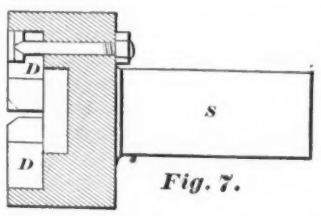


Fig. 7.

As will be seen in Figs. 2 and 3, the thread is cut away but very little at the back for relief from friction; and it has been found the easiest and best method to lessen friction by having the cutting edge "lined" in so as to cut freely the right size, and to be guided by the amount of thread left in the die. If too much is cut away the die will strip the thread; if too little (and not relieved as stated before), the die will cut hard, requiring a large amount of power, besides heating the work so that on cooling it may be smaller than the required size.

As taps and dies usually go together, a few words on taps may not be out of place, for taps must be just as accurate as dies, and on turret work of a particular nature be just as easily adjusted. This is harder to accomplish in a tap of ordinary size, on account of being limited as to space; for while in a die you can work "outside" of size to be cut, in a tap you must work "inside."

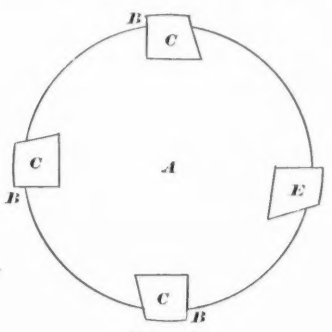


Fig. 8.

For small taps of one inch and under, there seems to be no means of adjustment except splitting a solid tap and open it by screws or plugs as it wears. But above one inch we can make taps adjustable quite easily, the larger sizes being the easiest to handle. Fig. 8 shows the form most in use, and the simplest form of an adjustable tap that is substantial that we have. The body *A* is of machinery steel turned to the size to be cut *less the thread*, in other words, under the thread, and then planed for cutters *C*, having a bevel or half dovetail as shown, on the *back* side of cutter, so as to leave the cutting edge square. Plane large and deep enough to hold a substantial cutter, for it pays in the end to have a good firm cutter instead of a shallow one, as you are never sure of keeping them in place.

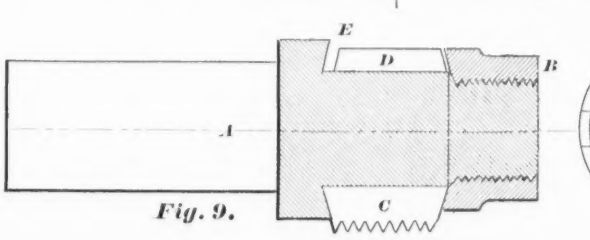


Fig. 9.

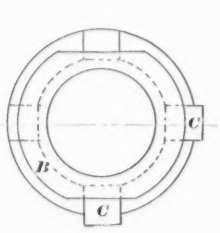


Fig. 11.

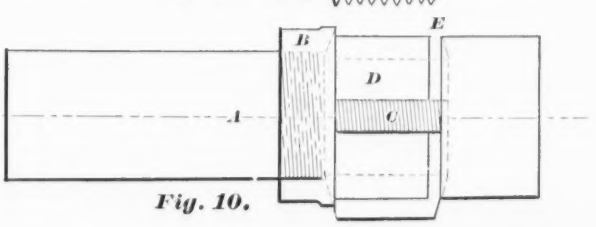


Fig. 10.

Some will contend that the cutting edges should be on a radial line from the center, and that is probably correct theoretically, but in practice it would be more expensive to plane to the peculiar shape this would render necessary (to give required strength to the shank or holder *A*), as *E*, Fig. 8, and as the arrangement shown gives entire satisfaction, and is much cheaper, the majority will adopt the practical form. Adjustment is obtained by putting liners underneath the cutters, as in any tool of this form. While these taps give satisfaction and cut easily, beside being very durable, and are our standard of adjustable taps—still we keep designing with a hope of improvement, and one of these designs being easily made, and not necessarily expensive, will send it along with the rest. This form is not admissible where a tap must bottom in a blank nut, but for work admitting of a guide on the tap—and a majority of turret work does—it it is a good form of tap. Referring to Fig. 9, *A* is the shank or body of tap—preferably of machine steel—with forward part shown in section, *B* is the nut which holds the cutters in place and forms the guide, and if necessary can be made in two pieces so as to have one act as a lock or check nut on the other, and prevent a possible loosening by friction in the revolving work. The cutter is shown in place at *C*, being held by the undercut in the body and the cone in the nut, while *D* shows the side of the planed groove, which, in this form of tap is merely a key-seat, being straight on the sides instead of dovetailed as in the other form.

The groove *E* is first turned in the shank, while in the lathe, to the required depth, and the grooves or key-seats planed into them, similar to the first form shown.

The liners can be laid in these, and the cutters forced to place by tightening the nut and held firmly, avoiding the driving as in the other.

This form can have the grooves and cutters planed straight, thus avoiding all "fitting," and saving much time in the making.

Fig. 10 is a modified form of the same tap—the clamping nut *B* being in the rear instead of the front, thus avoiding all danger of loosening the cutters by the nuts being unscrewed from friction. Fig. 11 gives an end view of Fig. 9, showing two cutters in place, *C C*—two grooves for the reception of the remainder and the nut in front. Four cutters is the number we use for nearly all sizes, though on the smaller sizes two is sufficient, and by having the body of tap just fill "under the thread," the danger of stripping is reduced to a minimum, very little trouble having been experienced from this cause.

Some years since Jersey City was granted certain rights in land mostly under water. Since then the Jersey Central Railroad Company has gone right on filling in these lands and appropriating them to its own use. Recently the city has sued for its rights, and secured a verdict likely to cause the railroad company some inconvenience and a considerable loss of money. The moral is that railroad companies should not meddle with property to which they have no claim.

Some wag perpetrates the joke—if it is a joke—that the reason why vessels flying the American flag always command attention and respect is because they are curiosities.

LETTERS FROM PRACTICAL MEN.

"Bearing Surface in Proportion to Wear."

Editor American Machinist:

Mr. Armstrong's letter on "Bearing Surface in Proportion to Wear," in your issue of June 12th, calls to mind a case in point under somewhat different conditions.

Some years ago, when the new Sellers planer was in process of evolution, the idea was suggested of guiding the table by one rail instead of two, making one way flat and the other V-shaped, with additional side faces, as shown in Fig. 1, to provide for heavy side cuts. The advantages of this method of guiding led to its subsequent adoption, and the question then arose as to what should be the relative widths of a and b to insure equal wear. It was at first assumed that $a - c$, the effective width of V, should equal b in order to have equal wear for loads divided evenly on the two ways, but an investigation of the question showed the fallacy of this assumption, and $a - c$ is now made wider than b, for reasons which will appear.

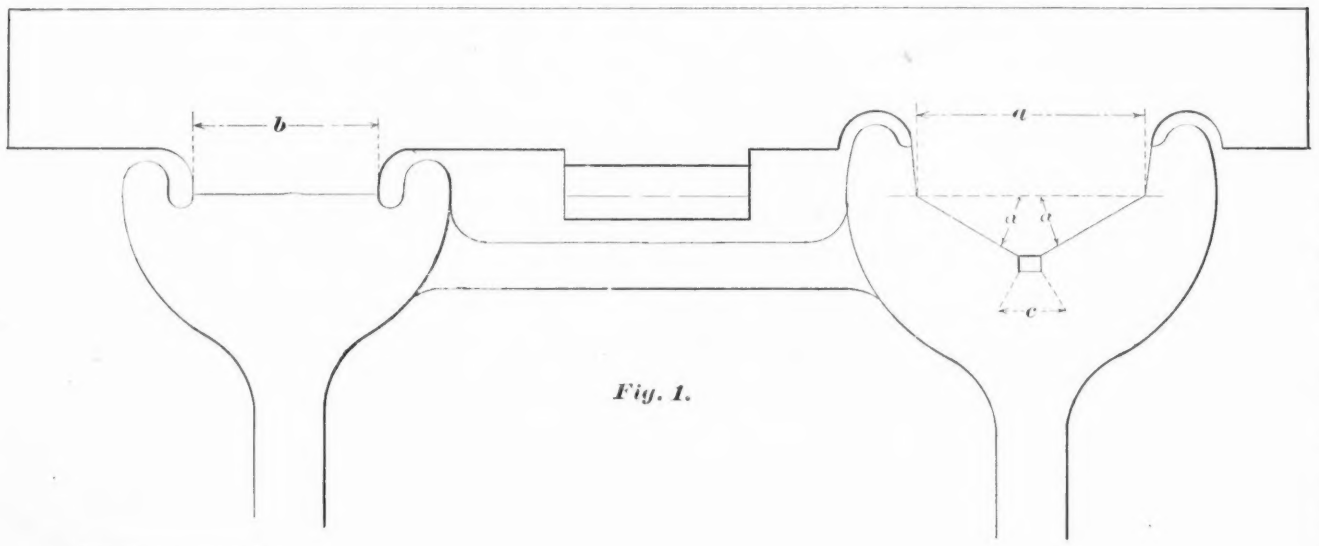


Fig. 1.

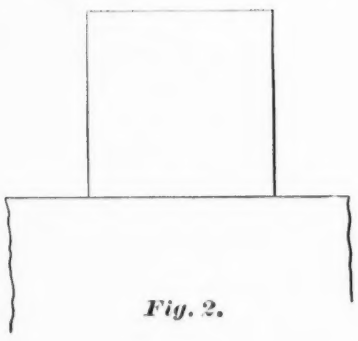


Fig. 2.

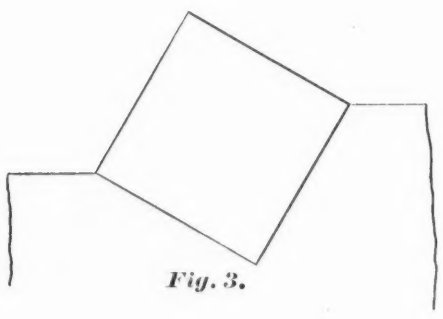


Fig. 3.

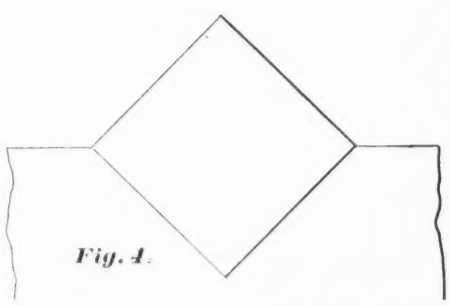


Fig. 4.

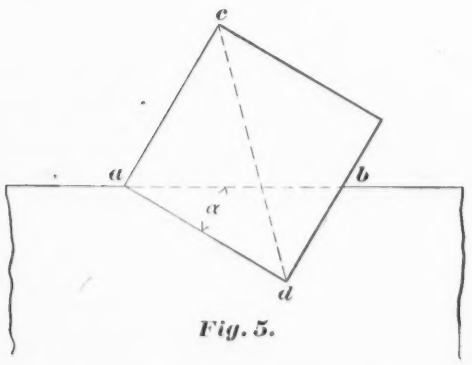


Fig. 5.

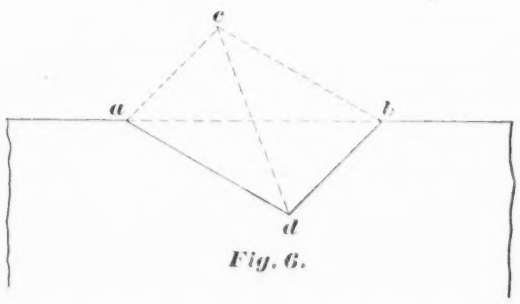


Fig. 6.

Let w = weight to be carried on either runway.

φ = coefficient of friction.

α = angle of V to horizontal plane.

d = effective width of $V = a - c$.

Then $\varphi\ w$ = friction on flat way, and $\varphi\ w$ sec. α = friction on V.

The wear being proportional to the friction, the sections worn off on the V side must be sec. α times the section worn off on the flat side, and, to have equal depth of wear, d must be equal to b sec. α. The side thrust in planing may at times be sufficient to drive the table hard against one of the side guides, but, in finishing, the table will always run on the lower V faces without bearing against either side guide, and, fortunately, the side pressure, whatever it may be, will not affect the relative depth of wear on the two ways, so long as the vertical pressure upon them remains unaltered. Should this proposition require a demonstration, it is only necessary to consider that, so long as the table runs in its V bearing the friction on that bearing is independent of side thrust, because side pressure can do nothing more than transfer the load from one side to the other of the V surfaces.

By a similar analysis it is interesting to note that a square shaft will wear down at the same rate, whether sliding on one side, as shown in Fig. 2, or on two sides, as shown in Fig. 3 and Fig. 4. The actual amount of wear is least in Fig. 2, but the depth of wear is the same for any position of the square, and the direction of wear is vertical in every case. The square shaft may also be supposed to slide in a groove cut in a plane table, as shown in Fig. 5, where one side is but partially imbedded, and in this case the depth of wear will be greater than in Fig. 2, and its direction inclined in the line of the diagonal $c\ d$.

For a V groove of any shape, as shown in Fig. 6, the friction and wear relative to that developed on a horizontal plane will be expressed by the distance $a\ d + d\ b$ as compared with the horizontal distance $a\ b$; and completing the parallelogram, the direction of wear will be that of the diagonal $c\ d$. Considerations of this kind might serve to advantage in machine design, but I do not think they are often applied, nor does it seem to be generally understood that the projected width of oblique bearing surfaces is not a good measure of their durability.

The problem of equal distribution of wear is an interesting and important study, but there are some cases, like those cited by Mr. Armstrong, which are so difficult to treat that it is hard to choose between the remedy and the disease. As Mr. Armstrong observes, a lead screw would not look very pretty when doctored as Prof. Sweet proposed, and to my fancy, a lathe shear with scattering cross grooves to equalize the wear would not be an attractive object of contemplation, but I see no valid objection to its use by those who prefer a shear that wears right, to one that looks right and is easily kept clean.

Philadelphia, Pa. WILFRED LEWIS.

Compound Locomotives.

Editor American Machinist:

I notice in recent issues of your paper that you have been devoting a good deal of space and matter to discussing the locomotive, compound and simple.

I am not a locomotive engineer, but simply an engineer that sometimes thinks a little.

I think the locomotive engine should be improved to be more economical as to fuel, and be made, if possible, to run faster with greater safety. I know it is a hard nut to crack.

The compound engine may be a good idea, and work well when the road is level, and the engine loaded to the economical point; if the load varies much, the engine can't work well; besides, compounding means a doubling up of a great many heavy parts that reciprocate, which seems to me to be bad for the road-bed, and also the engine.

The locomotive of to-day, with its link motion for reversing and cutting off, seems to do the business nicely, but not cheaply. Why doesn't it? Is it because we don't cut off early enough and expand the steam low enough, or is it because we cramp the exhaust in getting out of the cylinder?

I never saw a good indicator card taken from a locomotive, but would like to see one taken, such as I have seen from a well-loaded Corliss engine—with one exception, it should show more compression—cutting off at $\frac{1}{8}$ to $\frac{1}{4}$ of the stroke, 50 to 60 pounds M. E. P., 25 to 30 pounds terminal. Can such a card be obtained with link motion?

If a valve gear could be applied to a locomotive that would produce such a card, would there be any doubt about its universal adoption?

Hoping we will hear from some of the expert locomotive engineers through your columns, WM. K. AUSTIN.

Steam Distribution in Locomotives.

Editor American Machinist:

I will have to give the much-maligned link motion a "kick." Mr. Angus Sinclair says most of those who are trying to improve the distribution of steam in locomotive cylinders are laboring to popularize a delusion. Now it strikes me that it is as much as to say the link motion is the acme of perfection. He also says that the "reprehensible" card it produces is necessary to the efficient working of the locomotive. That is very true, only when applied to the link motion and the reciprocating valve.

What is the matter with a valve gear like this? Steam ports direct, clearance reduced to a minimum, exhaust continuous during entire stroke, exhaust lead and induction lead equal, range of cut-off during seven-eighths of the stroke, valves perfectly balanced, quick cut-off, cinders prevented from entering valves and cylinders, full-port admission and exhaust at all points of cut-off, throttle arranged in a way that the "perverse or indifferent engineer" will be compelled to regulate the speed by the cut-off lever, the reversing and regulation effected by mechanism that is stationary, except when moved to reverse or change the point of cut-off.

If such a valve gear will not effect a saving of 40 per cent., or at least 30 per cent. of the fuel now used, then I have spent about twenty years in experiment and study for naught.

Or the same gear applied to two-cylinder compound with switching valve, so that they may be worked as simple engines when starting or on heavy grades, the regulation to be effected by cut-off same as with simple engines. JOHN E. PRAUL.

Philadelphia.

Involute and Epicycloidal Forms of Teeth.

Editor American Machinist:

Mr. Clough's experience with gear teeth, as related in your issue of June 26th, is not a good argument in favor of the epicycloidal form of teeth as compared with the involute form. It is useless to consider the matter of comparative value from the standpoint of personal experience. A lawyer can find any desired number of experts to prove any sort of nonsense that he is supporting, and the opposing counsel can produce as many to swear to the exact contrary. Such discussion is interminable and useless.

Whatever difference there may be between the involute and the cycloidal forms of teeth, and there are differences, there is none in smoothness of theoretical action, and, therefore, both forms will run with equal perfection, if the teeth are formed with equal mechanical perfection. Mr. Clough proves nothing whatever, but the fact that a certain badly cut involute gear was inferior to a properly cut cycloidal gear. In fact, no amount of such evidence could prove anything else.

One reason for defective involute teeth is that the cutters have but eight to a set, while cycloidal cutters are made with twenty four to a set. Therefore, if the number of teeth being cut happens to be far from the number for which the cutter is properly shaped, the cycloidal tooth has the advantage; it may be described as an advantage of numbers, three to one.

Again, the involute cutters on the market, those used by the "parties" Mr. Clough speaks of, have been very materially improved within a few years past. It may be that the parties used old style imperfect involute cutters, and new style cycloidal cutters, and then condemned the involute curve.

I know "parties" who can cut a very poor gear with a very good cutter. They are not rare, and perhaps Mr. Clough's friend was one of them. After cutting a set of involute gears and throwing them away, it would be very natural for him to take particular pains with the next set.

I once investigated that matter in the Worcester machine tool shops, and found a variety of opinions. One concern used the cycloidal tooth, because it was better than the involute, and the next concern used the involute because it was better than the cycloidal. The experimental style of argument amounts to just nothing at all, and no matter what experience Mr. Clough can cite

in favor of the cycloid, as good an experience can be cited to the contrary.

Mr. Clough speaks of the "radius of curvature" of tooth curves. What's that? We sometimes, in fact generally, use circular arcs for the curves of rough wooden or cast gears, but no one makes cutters that way who knows how to make cutters.

Mr. Clough rightly gives great value to the "rolling contact" action of gear teeth, but he will get his fingers burnt with that argument. Under similar circumstances the involute tooth has an action that is more nearly rolling than that of the cycloidal tooth.

The simplest and best tooth curve, theoretically, as well as the one in the greatest practical use for cut gearing, is the involute.

GEO. B. GRANT.

Making Rolls.

Editor American Machinist:

I see in AMERICAN MACHINIST, June 12, that Mr. Bender has not yet found any relief; I here present a case I had to wrestle with twenty-five years ago. I give details, in hopes they may inspire some hints in the direction of success.

A pump rod was to have a sleeve cast on and finished, our moulder (a good one) tried his best to make a perfect job, but it was "spongy" every time. I had made suggestions to him, but he was stubborn, and thought his way the best. At the third failure, when the first cut was taken off on the lathe, I called him to come and see his work; he scratched his head and was mum; then I insisted he should try my plan as per sketch—the cope C has two longitudinal ribs r r studded with nails for holding the sand when the riser pattern W is withdrawn, the gate G has a capacious pocket P in lower flask F, and the headers l l at the ends are broader than those near the centers as shown; the neck of the riser W was (in my case) $\frac{1}{4}$ inch thick, and was easily cut off in the planer; the job turned out first-class.

In Mr. Bender's sketch in AMERICAN MACHINIST of April 24, he shows no fillets in heads of the large rolls; they would certainly help him a little. I would also suggest the use of large perforated pipe-core centers instead of wooden ones, as they are usually vicious, and to put in the cores as warm as possible, not long before pouring, to expand the air or gases in the mould.

The riser W can be of any height, but in all cases it should be the full length of the casting or roll. A. E. DUPAS.

New Orleans, La.

Hours of Labor and Social Conditions.

Editor American Machinist:

In my own opinion the most accurate method of arriving at a true estimate of the position of the people of a country is to note their hours of labor. The shorter the hours the better is their general lot; for, as a general thing, the pay of a workingman the world over is only such as at most finds him a fair living. Some save money because they are thrifty, and clever in managing, and so get on beyond the general crowd; but the crowd earn a living, and where they can do this in ten hours they may be said to be better off than where they do it in twelve hours, and so on.

I have no faith in long hours. When in Holland I took note of the shop laborers, and how they worked. It took three men of full size as long to move a few weights as I would have done with my left hand alone, unaccustomed as I am to muscular exertion. I was on the point of impropriety of speech when I recollected that those three men had worked from about 4.00 A. M., and would go on to about 9.00 P. M. In that long day they went at a long day's pace, and did no more actual work, if so much, as an English laborer would do in his nine hours day. They simply smoked and loafed the day away. Of course they could not do such a long day of real work, and keep in health.

You make some remarks anent the prompt stoppage of work when the bell rings. Of course one is guided in these matters by the general treatment accorded to workers. Where there is stringency as to being absent when the bell sounds to commence work, there ought to be equal stringency to enforce quitting in the evening. I should like to see a copy of strict rules, with the addition:

"Every one employed in this shop will be expected to clear out within five minutes after the bell has sounded. Penalty for non-compliance, —— cents."

Why on earth should a man do a hard day's work, and then be expected to add fifteen minutes for nothing?

It may be that if he remains two minutes past his exact time he will miss his train home, and need to wait an hour for another; and he ought to be allowed to work this other hour, and be paid for it, if any delay in ringing the bell has robbed him of an hour at home.

Then it must not be overlooked that when the bell does ring to quit work, it is usually in nine shops out of ten only a signal that work has already been prolonged two to five minutes past nominal closing time. I know places where the employer gets ungrudgingly many hours of extra work from first-rate and steady men; but such employers are not many. When found, they are courteous and civil to all; they gather about them the best men, and they pay good wages, and I firmly believe they get good returns in work. Though I consider a man who has to work to a bell has a right to quit with the same, I am no lover of bells. Some days I work eighteen hours with ease; on others I don't work six hours. Did I own a shop I should rather like to try to get about me a set of steady men, to whom I should like to pay good wages, and who would work as they pleased, coming in just as soon as they felt fit, and leaving when they found work drag on them. Such a shop would turn out as much work as one with a code of rules a yard long. What is wanted in this world is more fair dealing all round; more elasticity. Why within reason should not a shop run on a wet Saturday afternoon, and lay off for the half holiday on Monday instead, when fine? Simply because, as things are now constituted, everything is govered by the insane doctrine of competition—a doctrine which is destructive of all moral sentiment, either as between individuals or nations, and which, instead of stimulating human nature to higher excellences, has as yet only served to develop selfishness, greed and avarice. Competition forces down wages to the point of starvation. This is the heaven-born theory of supply and demand worked to its conclusion. At starvation a check is given to further decrease, because animals must feed or they cannot work.

Competition is the direct outcome of dishonesty; the worker won't do fair work; the employer won't pay fair wages, or he is beaten by the man who pays less, and so the miserable cycle is repeated. We want honesty, not merely as between man and man, but between one nation and another one town and another, and one State and another, and until such time arrives the condition of the mass of the people can never improve. W. H. BOOTH.

Recently some workmen in Russia found a loaded shell lying around loose, and conceived the brilliant idea of setting it on end, and using it as an anvil. The first blow caused a rather disastrous explosion · Evidently they "didn't know it was loaded."

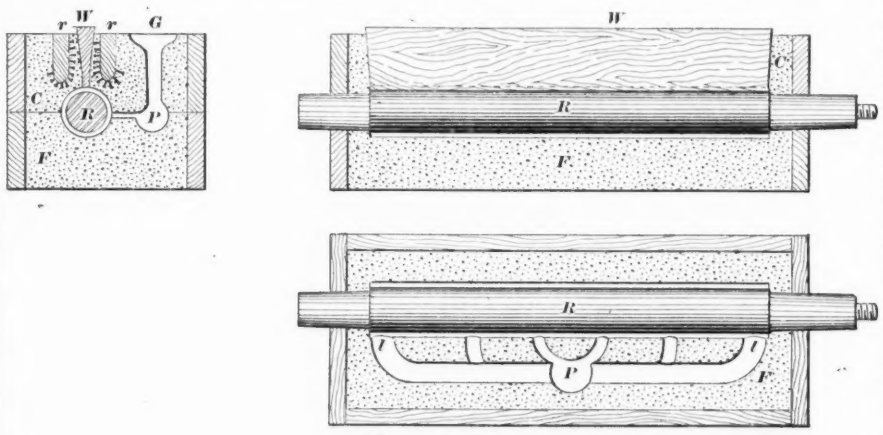
Force in the Steam Engine and Its Relation to Smooth Running.

TWENTIETH PAPER.

BY PROF. JOSEPH TORREY.

This series of papers has thus far followed out elementary principles, and the aim has been to present the all-important subject of engine design, as modified by the demands of high rotative speed, in an elementary manner quite within the reach of any one likely to be interested in engine construction. In this concluding paper of the series I propose to draw some conclusions. If they do not seem to be warranted by the facts, they can be readily set aside.

In the first place, then, I think the subject of inertia should have more respectful attention on the part of builders. The relation between rotative speed and weight of reciprocating parts should be a known and pre-determined quantity. Of course I am speaking now of stationary engines. High-speed engines of course require the more care, but if the speed of all engines, short or long stroke, is going to be pushed forward as rapidly as at present, the time will certainly come when the proportions and constructive details of so-called low-speed engines will need considerable modification. As to the relation mentioned above between speed and weight of parts. It is my opinion that the combination developing sufficient inertia to neutralize about $\frac{5}{8}$ the total steam pressure at admission at the back end will give good results. If the conditions of good economy permit compression to be adjusted so as to just absorb the momentum of the reciprocating parts at the front end, and a little more than absorb it at the back end, the results will be *perhaps* improved.



MAKING ROLLS.

As to proportioning the different parts and distributing the weight, I think the conclusion is a perfectly fair one, from our examination of the subject of counterbalance, that the piston, crosshead and body of connecting rod should be made as light as is consistent with strength. The piston rod should be turned about $\frac{1}{8}$" larger where it runs through the gland, and should overrun at every backward stroke. If this is done the awkward occurrence of shouldered piston rods will be less common. The same remark or principle ought to be observed in the design of piston, valve rod and valve. The crosshead can be made light by casting it hollow, of course.

After proportioning these parts, the residual weight is to be put into the large end of connecting rod. As crank-pins and connecting rods are proportioned ordinarily, this will make a clumsy rod—a thing not to be tolerated—but if engine builders could only bring themselves to increase the size of crank-pins a little I believe this difficulty could be met, and other advantages gained beside. Good engine builders ordinarily allow about 800 to 850 pounds steam-pressure per square inch of projected crank-pin area. With this allowance, the projected area of the pin would be determined by multiplying the area of piston by the assumed steam pressure, say 100 to 120 lbs. per square inch, and dividing by 800 or 850. Concerning this method of calculating, one thing might be mentioned, not by way of criticism, but simply as a matter of fact, namely, that this method of calculation is meaningless, except as to results. Suppose we determine the size of a crank-pin, proportioning it for 800 pounds per square inch of projected area. Even though the steam pressure (initial) should be 120 pounds per square inch, the pin would never be called on, in a high-speed engine, to sustain more than half this amount, owing to the action of inertia, and in the majority of cases the initial pressure in cylinder will be nearer 80 pounds than 120, by a large margin, and in this case the pin will very rarely have to sustain more than one-half this pressure, so that the method of calculation used gives really a *factor of safety* of 3, or thereabouts. There is nothing mysterious about this, but I have heard many discussions on journal friction, in which mention was made of engine crank-pins sustaining safely 800 pounds per square inch of projected area, when in point of fact, such a case is almost unheard of. The rule gives results which are generally satisfactory, but it is purely arbitrary.

If, now, we should change the constant from 800 pounds to 600 pounds per square inch, the result would be, of course, a larger pin. For instance, for a 12x12 engine, the pin at 800 pounds per square inch would be 3.5 inches long and 4 inches diameter. At 600 pounds per square inch it would be 3.5 inches long by 5.5 inches diameter, and this would necessarily result in the crank end of the connecting rod being notably larger, making it possible to more easily concentrate weight at that point. If any one thinks there is much uniformity about practice in regard to crank-pin dimensions, I advise him to carry a foot-rule and measure crank-pins off-hand for a while on the representative high-speed engines of the day. He will find about as many shapes and sizes as there are engines. The reciprocating parts having been designed, the next thing, in a high-speed engine, is to decide on the proper amount of counterbalance, and proportion a suitable counterweight. If the principles previously laid down have been carried out, then, whatever be the type of engine, whether side crank or center crank, the balance can be pushed considerably further than is generally considered best in ordinary practice, and the bad effects, vertical disturbance, etc., will be found to have been eliminated in a great degree. The reasons why are fully explained in previous papers. Center-crank engines can readily be balanced completely and in side-crank engines about $\frac{3}{4}$ the horizontal disturbance can be corrected. The general practice should be to put side-crank engines on a cast-iron sub-base, which makes the whole engine self-contained. I know it is true that, if an out-board pier is properly designed and built, it will settle to about the same level as the main foundation. I know, too, that it is a very difficult matter (or has been) to get purchasers to pay for the extra iron; but I am inclined to think things are changing for the better. The high-speed "boom" is over. The wild cat element is fast disappearing, and it is now no necessary inference that an engine must be a good one because it turns fast and high speed is all the fashion. Sound engineering and the best of workmanship are the only available instruments of war at present. The high-speed, rattle-trap, hopelessly out of line, and hopelessly strained and worn after a month's run, must go.

The recent explosion in the hold of a large iron steamer at Chicago, by which many lives were lost, emphasizes the necessity of great care in handling materials likely to evolve explosive gases. The vessel was loaded with kerosene, gasoline and cotton, and at this writing it is believed that gas was evolved from leakage of the kerosene, and that when lanterns were carried into the hold, to enable the stevedores to work, this gas was ignited.

The *Industrial World* says:

A steam pipe cement can be made with linseed oils, varnish, ground with equal weights of white lead, oxide of manganese and pipe clay.

Wonder what such a cement would be good for.

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CONTENTS.

PAGE.
Some Recent Improvements in Screw Machines. 1, 2
Exhaust Pipe Nozzles and Steam Passages. By J. A. Hill. 2
A New Cotton Gin 2, 3
The "Vesuvius" and Her Armament. By M. W. Sewall 3, 4
Shop Notes. 4, 5
Tools for Brass Work. By Fred H. Colvin 5
Letters from Practical Men: "Bearing Surface in Proportion to Wear." By Wilfred Lewis—Compound Locomotives. By Wm. K. Austin—Steam Distribution in Locomotives. By John E. Praul—Involute and Epicycloidal Forms of Teeth. By Geo. B. Grant—Making Rolls. By A. E. Dupas. Hours of Labor and Social Condition. By W. H. Booth 6, 7
Force in the Steam Engine and its Relation to Smooth Running. By Prof. Joseph Torrey 7
Regarding the City of Paris Accident 8
A Subway Conspiracy 8
The Stationary Engineers' Annual Convention. 8
Questions and Answers 9
Manufactures 9, 10
Notions and Vagaries Concerning Men and Things Mechanical—Steel Balls. By Jarno 11
Working Aluminum 12
Boiler Compounds 12
Machinists' Supplies and Iron 12

Regarding the City of Paris Accident.

The *Engineering News* of this city, it seems, is not entirely satisfied with the finding of the Court of Inquiry regarding the City of Paris accident, and says:

"How an engine could so suddenly break down without the slightest previous warning, from a gradual wearing of a bearing, is a question which the court judiciously ignores, but it seems to us a question incapable of answer without destroying its accepted theory of the accident."

Now, it seems to us that, if there had been so very much ignoring business by the court, then the *Engineering News* could not have known what the court's "accepted theory of the accident" was. For the benefit of our contemporary may we be permitted to say that when one of the bearings of a shaft (any shaft, whether propeller shaft or any other kind) wears down as much as 7 inches below the others, it is conclusive proof that the shaft is deflected to that extent, and that as it revolves this deflection is constantly changed in direction, the fibers of metal being alternately stretched and compressed? It has been shown repeatedly that this is apt to produce fracture, and any practical man would confidently expect a fracture from that cause, if the shaft were kept running. And when the moment of fracture arrives it is always sudden, we cannot conceive how the engine could be expected to give any "previous warning" whatever of such an event. And when suddenly released of its entire load, and being without a governor or anything else to check its speed, we think it the most reasonable thing in the world to expect that speed to increase very quickly to the point of danger to the engine. Shafts are continually breaking from similar causes in mills and factories, and there is every reason to believe that there would be numerous cases of the wrecking of stationary engines in this way, if they were not invariably provided with governors which prevent their running away. We do not believe in trying to throw a great air of mystery about such an occurrence, when the perfectly apparent causes are sufficient to account for the accident.

Since writing the above, the *Iron Age* has appeared with an editorial, in which it pronounces the finding of the court "extremely unsatisfactory." The value of this opinion by our esteemed contemporary may be inferred from some statements made further on in the same article, where, in referring to the opinion that abnormally high speed might have caused a stretching of the connections, it says:

If this means that the 12-inch piston rod and 14-inch connecting rod stretched sufficiently to permit the piston to strike the lower cylinder head, and thereby wreck the low-pressure engine, then the question naturally arises: Why did not this high velocity produce the same results with the high-pressure and intermediate engines, which were practically unharmed?

Of course, if there was stretching, any one familiar with such matters would know that the *upper* cylinder head would be struck, not the lower one. And the query at the end of the above quotation may be answered by the simple statement that the piston rods and connecting rods for all the cylinders of such an engine are usually made of the same size, and never differ materially in this respect, for the reason that each cylinder is designed to do the same work under normal conditions.

It follows from this, as a matter of course, that when the normal speed is exceeded the point of danger will be reached by the pistons as the speed increases in the order of their size, commencing with the largest, and the engine, therefore, did just what should be expected of it under the circumstances.

A Subway Conspiracy.

No better illustration of the utter disregard for the interests of the public on the part of large monopoly-controlling corporations doing business in the city of New York has been afforded than their operations in connection with the matter of putting their wires underground instead of having them strung through the streets. Our readers are, of course, more or less familiar with the history of their efforts in the past to prevent the plain will of the people being carried out in this matter, in which they have shown conclusively that they care for nothing whatever except to pile up wealth, and are not overscrupulous as to the means by which they do it. Suit has recently been brought by the North American Underground Telegraph and Electric Company against the corporation which, under a contract with the Board of Electrical Control, has been constructing the subways, and, in connection with this suit, some charges are made, with offers of proof, which, if proven, will tend to open the eyes of many people and explain some things which have been more or less mysterious. The substance of the charge is that the company bringing suit had contracted to put in its particular form of subway, the contract being made with the subway company, with the approval of the Board of Electrical Control. After putting in a few miles of it the contract was suddenly and arbitrarily broken, and another form of subway substituted, which is declared to be inferior, and, in fact, worthless. This is accounted for by asserting that the Western Union Telegraph Co. and the Bell Telephone Co., having secured control of the subway company by purchase of a majority of its shares of stock, took this plan of arbitrarily substituting a worthless plan for a good one in order to make it appear that the subway system was a failure in New York, thereby influencing the action of the authorities in other cities where these companies have wires that they do not wish to take down. If this is true, then of course the Board of Electrical Control is involved, because no change of that kind could have been made without its approval. And the ignorance of the board regarding the matters over which it is supposed to have control in the interest of the citizens cannot be pleaded in extenuation, for means are provided by which it can avail itself of the best engineering talent in deciding upon such matters. We do not wish to prejudge the case, but we must say that it looks like a very bad piece of business, even for this town, where corruption is rife. There is nothing in the past history of these two great monopolies which would lead one to believe that either of them would hesitate to do such a thing if it was thought that anything was to be gained by it, but there are signs that the patience of the people is becoming exhausted, and we wonder how much longer it will hold out. And we wonder also whether or not, if these charges are proven, it would be a good opportunity to apply some of those very severe laws against conspiracy about which we heard so much some time ago in connection with the efforts of sundry workingmen to better their condition a little. The methods of these workingmen may have been ill-advised and wrong, but they were trying to secure things which scarcely any one will deny it would be a good thing for them to have. Does any one think that these two great monopolies are in need of the money they are trying to make by these operations? They already have more of it than is good for them or the rest of the country. If this conspiracy which is charged against them is proven, it would have a wholesome effect if some one were to be slammed into prison for it.

The Stationary Engineers' Annual Convention.

The National Association of Stationary Engineers will hold its next annual convention at New York, beginning Sept. 2. Matters of considerable interest are likely to come before the convention. This association consists of an important body of men, and has grown rapidly in numbers and influence since its organization in 1882.

It lets the question of wages and strikes for any purpose entirely alone, being organized for different purposes, viz., those of mutual help and mutual improvement. In these directions commendable progress has been made. At the meetings of the subordinate associations questions relating to the vocation of the members are discussed, and lectures are listened to. Such a course cannot be other than beneficial, not alone to the members, but to the community as well, especially to users of steam power.

The pipes of the New York Steam Heating Company have been declared by the Board of Health to be a nuisance, dangerous to health, and their use in certain streets and portions of streets ordered discontinued. Of course the steam pipes are not going to be given up without a contest, however, and what the outcome will be it is hard to say at this time, though it seems to us hardly fair to charge all our subterranean troubles to the steam pipes. One of the points most strongly urged against them is that they heat the earth under the streets and vaults under buildings to over 200°, making them dangerous to health, which seems strange to us, as, we should think considerations of economy, if nothing else, would cause the company to take measures to prevent so much promiscuous and unpaid-for heating. Surely, if much heating of that kind is done, considerable coal is required for the doing of it. We have seen snow lying all winter on the covering of a steam pipe supported on brackets along a side wall facing the north, the steam being used to drive an engine situated at some distance from the boilers. If the pipes of the Steam Company were in a tunnel, such as we have advocated for years, there would be no trouble from them. They could be covered with non-conducting material, and it could be kept in proper condition for performing its function. This is the only real solution of the difficulty, and picking out some one of the companies using the streets, and making it bear all the burden of blame, does not seem just fair to a man up a tree.

Those of our readers who have been following Prof. Joseph Torrey's articles on "Force in the Steam Engine and Its Relation to Smooth Running," will be gratified to see the subject renewed in this issue, and it is also of interest to know that the professor has made a change in location from Iowa College, Grinnell, Iowa, to Harvard College. In making his apologies to us and our readers for the long interval between this and the preceding paper, he writes: "The moving has, of course, made it impossible to do anything literary, and most energy expended has been mechanical, and devoted to the moving of household articles of various shapes."

Our readers will, of course, join us in the hope that he was able to control these forces in such a way as to secure "smooth running," and that abundant success will attend him in his new field.

Two traveling cranes which in some respects will be unlike any others yet built, are to be put into the Baldwin Locomotive Works by William Sellers & Co. They are each to be of 100 tons capacity, with a span of 75′ 4″ and 336′ run, and are to be driven by electricity. The maximum speed of the bridge travel will be 200′ per minute; trolley travel 50 and 100′, and main hoist speeds 5, 10, 20 and 40′ per minute. It is the intention to handle and transfer from one track to the other the heaviest locomotives complete by means of these cranes, while for handling parts and lighter loads there is an auxiliary hoist capable of lifting 1,000 lbs. at a speed of 100′ per minute.

That was rather a strange proceeding, between a manufacturers' association in New York and their employes, by which the latter were to be locked out until they severed their connection with their union, and were then given the privilege of joining it the next day—or the same day as to that matter—and continuing work.

Ten contract laborers who recently arrived at Philadelphia were detained, it being found that they were imported to work for a cigar maker at four dollars a week and lodgings; say, as lodgings go, about four and one-half dollars a week. Well, they ought to be sent back.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(283) A. T. H., Reading, Pa., asks: Which is best for bending—square or round steel of equal cross-sectional area? The bends are to be at right angles, like bicycle cranks. *A.*—The round steel will be best for the purpose.

(284) O. H. K., Wilmington, N. C., asks: Will it be necessary to have a certificate before going on a locomotive as engineer? *A.*—In the State of Alabama you will require a license; in all the other States, as far as we know, you will not need one.

(285) C. H. W., Wilkes-Barre, Pa., writes: Please give the horse-power of a stationary engine of the following dimensions: Cylinder 16 inches diameter, 32 inches stroke, 80 pounds boiler pressure, speed, 50 revolutions per minute. *A.*—We should estimate it at 65 indicated horse-power.

(286) C. H. M., Grand Crossing, Ill., writes: Please give rule for finding the diameter of the low-pressure cylinder of a compound engine. *A.*—See answer to Question 6 in our issue of January 2, current volume. 2 I am told the point of cut-off in the high-pressure cylinder has to be determined by calculation. I don't believe it. *A.*—It is often computed, sometimes it is chosen.

(287) X. Y., ———, writes: Can you give me about the average cost per pound of ordinary commercial plain slide valve engines sold now so largely throughout the U. S.? I have heard it stated that where proper system prevails quite a good plain engine could be turned out for 6 cents per pound, while others claim it will cost 9 cents per pound. These figures are based on castings at 2 cents per pound. *A.*—We believe that in a shop in which a good system prevails, and which is favorably situated, the first cost of ordinary slide valve engines will not be over 6 cents per pound.

(288) W. J. C., New York, writes: I have just put in a pipe from a well to my kitchen pump. I used about 50 feet of common iron pipe. The water tastes very bad on account of the iron. Will this be any permanent injury to the well, and is there anything I can do to remedy it? I thought perhaps there was some kind of a coating solution with which I could coat the inside of the pipe, to prevent rusting. *A.*—The pipe will not permanently injure the well, but it will corrode rapidly. We do not know of any solution for coating the pipe which will be satisfactory. The best way will be to use galvanized iron pipe.

(289) P. T., Denver, Col., asks: Will there be any difference in the pressure against which pumps have to work under the following conditions: One pump is placed at the sea level, another at an altitude of 10,000 feet, both pumps working against a pressure due to a column of water 500 feet high open to the atmosphere at top. *A.*—A column of water 500 feet high will weigh more at the sea level than at an altitude of 10,000 feet above, consequently the pressure against which the pump has to work at a given altitude will be less than that at the sea level, but the difference will be so small that it may be neglected. It must be remembered that a pump in a high region will not lift water to as great a height as in a low one, because the pressure of the air varies at different heights; at the sea level this pressure is 14.7 pounds per square inch, and at 10,000 feet above it is a little less than 10 pounds per square inch.

(290) N. B., Rockville, Conn., writes: I wish to speed up a breast wheel to twice its present speed. Where shall I make the changes in order to gain power? The size of wheel is 20 feet; speed, 3½ revolutions per minute; diameter of jack gear, 42 inches; diameter of bevel gear, 72 inches; diameter of receiving wheel, 30 inches; diameter of driving pulley, 96 inches; and that of the receiving pulley, 48 inches. I believe it has been done incorrectly by reducing size of receiving pulley one-half. *A.*—It can be done by reducing the diameter of the 48-inch pulley, but in this case it will not be practical to reduce it to one-half. We should reduce the diameter of this pulley a little, and also change the diameters of some of the gears; but whether that is possible we cannot tell, since we do not know how the gears are arranged. You will gain speed by making the change, but you will not gain any power.

(291) H. W. S., Plantsville, Conn., writes: Please state the limit of pressure to which the journals of high-speed steel shafts may be subjected. *A.*—It has been found by experience that when the pressure per square inch exceeds a certain amount, the oil or other lubricant is squeezed out, the contact becomes that of metal-and-metal, and the bearing cuts or abrades in spite of even constant lubrication. There is also with every pressure a certain velocity, beyond which the bearing will become heated. Hence it may be said that the pressure depends upon the efficiency of the lubrication, the speed, and upon the material of which the bearing is made. It is, therefore, difficult to give the limit of pressure. For line shafting making about 250 revolutions per minute, we should aim not to exceed a pressure of 30 pounds per square inch of projected area of the journal. For crank-shafts or crank-pin journals, this pressure is, of course, much greater, and here even the pressure will depend upon the class of engines, as these work under varied conditions.

(292) J. B. P., Cambridgeport, Mass., writes: Please give me a formula for finding the thickness of plates to stand a given steam pressure as shown in Figs. 1 and 2. Please give formulas for wrought and cast-iron, brass and steel plates. *A.*—Fig. 1 represents a plate simply supported by the end of a cylinder; the plate is subjected to a uniform pressure on one side. In this case

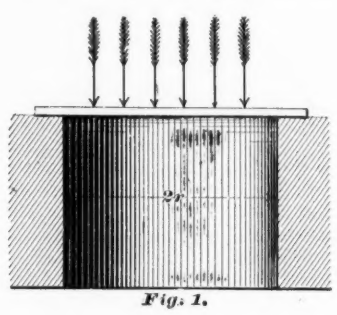

Fig. 1.

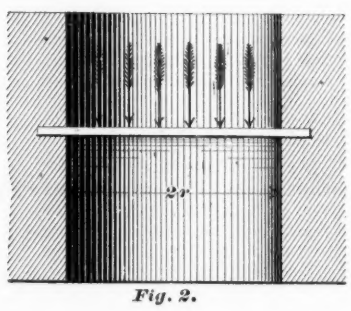

Fig. 2.

the greatest working stress to which the plate should be subjected is

$$f = \frac{5}{6} \frac{r^2}{t^2} p \quad (1)$$

In which f denotes the working stress; r, the radius in inches; t, the thickness in inches; and p, the pressure in pounds per square inch. From the foregoing formula we obtain

$$t = \sqrt{\frac{5\, r^2\, p}{6\, f}} \quad (2)$$

Suppose for instance the plate is of wrought-iron whose tensile strength is 48,000 pounds. Taking a factor of safety of 8, the working stress f will be $\frac{48{,}000}{8} = 6{,}000$ pounds per square inch. Now, let the radius of the cylinder be 10 inches, and the pressure 18 pounds per square inch; it is required to find the thickness of the plate in which the working stress is not to exceed 6,000 pounds. Here we simply substitute for the symbols, in formula 2, their values, and obtain

$$t = \sqrt{\frac{5 \times 10^2 \times 18}{6 \times 6{,}000}} = \sqrt{.25} = .5$$

of an inch for the thickness of plate. For steel plates, cast-iron or brass plates, etc., the foregoing formulas are also applicable, with this exception, that the proper value of the working stress f must be assigned, and this working stress will depend on the tensile strength of the material, and this tensile strength can be found in any engineer's pocket-book. To illustrate: Suppose that in the foregoing example the plate had been of steel, whose tensile strength is 80,000 pounds per square inch, and using the same factor of safety as before, namely 8, then the value of f will become $\frac{80{,}000}{8} = 10{,}000$ and the thickness of the plate will be

$$t = \sqrt{\frac{5 \times 10^2 \times 18}{6 \times 10{,}000}} = \sqrt{.15} = .38$$

of an inch.

When it is desirable to find the pressure which a plate of a given thickness can sustain, we have from formula (1), the following:

$$p = \frac{6\, f\, t^2}{5 r^2} \quad (3)$$

In which the letters denote the same items as before. For example: What pressure can a wrought-iron plate sustain whose thickness is ¼ inch, radius of cylinder 10 inches, and the working stress f is not to exceed 6,000 pounds per square inch?

Here we have

$$p = \frac{6 \times 6{,}000 \times .5^2}{5 \times 10^2} = 18 \text{ pounds per square inch.}$$

When a plate is firmly fixed as shown in Fig. 2, we have the following formula:

$$f = \frac{2}{3} \frac{r^2}{t^2} p \quad (4)$$

From which we obtain

$$t = \sqrt{\frac{2\, r^2\, p}{3\, f}} \quad (5)$$

and

$$p = \frac{3\, f\, t^2}{2\, r^2} \quad (6)$$

Formulas 1 and 4 have been taken from W. C. Unwin's Elements of Machine Design (last edition). Your other question was answered in our issue of June 19th.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Lexington Cut Iron Gears. See adv. on p. 20.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Engineering Co., Philadelphia and N.Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. Vanderburgh, Wells & Co., 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

Ice and Refrigerating Machines, 155 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book mailed free by Jas. E. Hotchkiss, 120 Liberty st., N.Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Castings for small and medium-sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio.

Milling Machines. Pedrick & Ayer, Philadelphia, Pa.

Universal Grinding Machine. Pedrick & Ayer, Philadelphia, Pa.

Standard Tool Co.'s Twist Drills. S. A. Smith, 23 S. Canal st., Chicago, Western Representative.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

Get particulars of our new Wall, Suspended and Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Audubon Machine Works, New Haven, Conn. Special machinery, heavy and light.

Well-drilling Machinery and Tools. Williams Brothers, Ithaca, N. Y.

F. C. & A. E. Rowland, New Haven, Conn. Hydraulic, Mill and Special Machinery to order.

One Star Hack Saw will do as much work as five of any other kind.—N. B.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See July 10, p. 18. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N.Y.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Patent Attorney. R. G. DuBois, 715 11th st., Washington, D. C., procures first-class patents on inventions. Valuable Hand-book on patents free.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal st., Chicago, Western Agent.

Horton's Chucks. We offer the balance of our stock at 50 per cent. discount. McFadden Co., Philadelphia, Pa.

25" 28" 32" 36" Upright Drills a specialty. Finely made, great capacity, quickly operated, prices low. Send for list of firms using our Drills. J. E. Snyder, Worcester, Mass.

25" 32" 37" 42" "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

C. H. Redman & Co., Newark, N. J., Manufacturers of Light Machinery, Automatic Selling Machines, Telephone and Telegraph Instruments, Sewing Machine Attachments, Models, etc. Contracts solicited.

For Sale—Bound volumes of the Patent Office Gazette for years 1883, 1884, 1885, 1886, 1887 and 1888. Price, $4 per year. Address J. C., care of AMERICAN MACHINIST.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations, 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt st., New York.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Stub Ends and Connecting Rods for small connections. Especially adapted for Valve Rod for Steam Engines. T. C. Dill Machine Co., Philadelphia, Pa.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton st., New York.

Screw Propellers. Manufactured by H. B. Roelker, 22 Cortlandt st., New York. Superintendent of the late De Lamater Iron Works, of same patterns and designs as before, adapted to each vessel. Consulting Expert and Constructing Engineer. Estimates on machinery, damages, etc. Air ice machines.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th st., New York.

MANUFACTURES.

A $500,000 cotton and oil mill is to be erected at Greenville, Miss.

A carriage factory and rolling-mill are proposed at Pell City, Ala.

A $1,000,000 cotton factory is to be erected at Montgomery, Ala.

A $500,000 stock company at Florence, Ala., will erect a cotton-mill.

Northern parties propose to establish a cotton-mill at Marble Falls, Va.

A $7,000,000 steel plant is in process of construction at Jacksonville, Ala.

The Baltimore United Oil Company will locate plant in Manchester, Va.

W. L. Yost is interested in a $150,000 cotton-mill to be built at Wytheville, Va.

Kirby & Co. are reported as erecting cotton gin and grist-mill at Byhalia, Miss.

At Denver, Col., the Columbia Screw Company has been organized; capital, $200,000.

The E. D. G. Jones Machine Works at Pittsfield, Mass., were put in operation recently.

A $100,000 flour-mill, with daily capacity of 500 barrels, is being erected at Columbus, Ga.

Two hundred thousand dollars have been invested in car-coupling works at New Orleans, La.

Beard & Son, of Greenville, will, it is reported, erect an iron foundry in Spartanburg, S. C.

The Marion (S. C.) Iron Works Company has been organized, with a guaranteed capital of $20,000.

New machine shops are in course of erection at Clifton Forge, Va., for the Chesapeake & Ohio Railroad.

Efforts are being made to organize a $200,000 stock company to erect a cotton factory at Vicksburg, Miss.

Samuel Croxton, of Cleveland, O., is investigating with a view of establishing an iron foundry at Dayton, Tenn.

It is stated that the Cardiff Coal and Iron Co. has broken ground for the erection of its iron furnace at Cardiff, Tenn.

A $25,000 stock company has been organized at Bridgeport, Ala., by A. C. Robinson, to erect a 100-loom woolen-mill.

A rolling-mill for the manufacture of merchant bar-iron from scrap is being built at Fort Worth, Terrant County, Texas.

A. K. Rarig & Co., of Columbus, O., have made a proposition to move their foundry and machine shops to Fort Payne, Ala.

A two-acre lot on Maury street, Manchester, has been given the Johnson Axle Company, of Richmond, Va., for a foundry.

The Orion Knitting Mill will start up a new factory at Kinston, N. C. The capital stock is $10,000. W. C. Fields is president.

The Georgia Chemical Works, at Augusta, have purchased a site for enlarging their works, and will double their capital stock.

S. H. Lockhart, of Greenbrier, will, it is reported, move his mills to Camden, Tenn., erect new buildings, and add new machinery.

The Brunswick (Ga.) Foundry and Machine Works are reported as enlarging their works by the addition of a building 75x53 feet.

Carley Bros., Colfax, Washington, write us that they are going to build a foundry to run in connection with their machine shop.

A $100,000 stock company is reported as being organized to erect a cotton factory, cotton gins, grist-mills, etc., at Orangeburg, S. C.

A. E. Huddlestun is rebuilding his planing-mill at White Sulphur Springs, W. Va., recently destroyed by fire, and will put in some new machinery.

The Wilmington & Weldon Railroad Co. (office Wilmington, N. C.), writes that it will not remove its Wilmington shops to Rocky Mount, N. C.

W. M. Neal is corresponding with a London (Eng.) capitalist, with a view to securing the location of a $1,000,000 cotton-mill in Helena, Ark.

J. P. Parker and others, Monroe, La., have organized the Ouachita Valley Cotton Mills. Capital stock, $250,000. The mill is to be built at once.

James McMillan, president of the Duluth, South Shore & Atlantic Railroad, as well as other connecting branches of the Southern Pacific system, has resigned his position.

Work has begun on the Hagerstown (Md.) window glass factory. The new company is on the market for a 30-horse-power boiler and engine, which will be put in.

The machinery for the Rome (Tex.) Roller Mill Company has arrived, and is being put in place. It is one of the latest improved pattern, and looks as pretty as parlor furniture.

The building formerly occupied by the waterworks machinery at Chattanooga, Tenn., has been bought by Thomas Evans, and will be equipped as an iron foundry and machine shop.

The works of the New York Bagging Company, Brooklyn, N. Y., were recently destroyed by fire. The fire started in a jute shute, and is supposed to be a case of spontaneous combustion.

The furnaces of the Chestnut Hill (Pa.) Iron Ore Company have shut down, owing to dullness of the market and a big stock on hand. A large number of men are thrown out of employment.

The Brunswick Foundry, Machine and Manufacturing Company, of Brunswick, Ga., is erecting the building for its foundry. The company will soon begin work on its marine railway.

The Shenandoah (Va.) Furnace Company has increased their capital stock from $250,000 to $500,000, and will begin the erection of a merchant mill as soon as possible after approval of plans.

The Georgia Pacific Railroad Co. will erect at Birmingham, Alabama, a wood machine shop and section of a roundhouse. It will probably erect machine, lumber and smith shops next year.

The Southern Iron Ore Co., with a capital stock of $150,000, has been incorporated at Rome, Ga., by S. C. Clarke and W. E. Goodwin, of Hartford, Conn., and L. B. Carey, of Floyd County, Ga.

H. P. Young and H. G. Rich have incorporated the Electric Protector and Specialty Co., to manufacture protectors for electric instruments, etc., at Newport, Kentucky. The capital stock is $10,000.

Charles Lauga is reported as organizing the Farmers' Cotton-seed Oil Extractor Co., to establish a mill at New Orleans, Louisiana, to manufacture cotton-seed oil by a process of which he is the inventor.

George Yellott and G. R. Shock, of Baltimore, Md., W. T. Roberts and others, have incorporated the Maryland Bolt and Lock Nut Co., to manufacture a patent bolt and lock nut. The capital stock is $100,000.

The Standard Cotton-seed Oil Co. has been incorporated, with C. M. Soria, president, and J. S. Rainey, vice-president, to erect a cotton-seed oil mill at New Orleans, Louisiana. The capital stock is $50,000.

Capitalists at Lockport, N. Y., are negotiating with citizens of Columbus, S. C., for the establishment in the last-named place of iron works, to manufacture a fine grade of iron from scrap by a new process.

The Secretary of State has incorporated the Industrial Iron Works Company, Kansas City, Mo.; capital, $75,000. The incorporators are J. H. Burton, C. A. Burton, T. H. Adams, C. J. F. Ridley and J. C. Klassen.

The Batesville (Arkansas) Iron Works Co. has been organized, with J. C. Bone, president; G. H. Kealer, vice-president, and C. T. Rosenthal, secretary, to operate an iron foundry. The capital stock is $6,500.

It is stated that a woolen mill, to manufacture ladies' cloaking, will be erected by a Northern company at Charlottesville, Va. Rhode Island capitalists will, it is reported, erect a $30,000 cotton-mill in the same place.

The Gardner Manufacturing Co. has been organized, with D. H. Irvine, of Orange Lake, president; Charles Rheinaur, vice-president, and F. N. Harrison, secretary, to erect a foundry and machine shop at Ocala, Florida.

Mills A and D of the Catasauqua (Pa.) Manufacturing Company have closed down for extensive repairs, and the building of a culvert across the feeder of the canal, which is being filled in with cinder for railroad purposes.

A new corporation, backed by Philadelphia money, is the Crab Orchard Coal and Iron Company, recently organized at Bristol, Tenn., with a capital stock of $200,000. William McGeorge, Jr., of Philadelphia, is president; Dr. M. M. Butler, vice-president, and W. W. James, secretary.

The Edison Machine Works at Schenectady, N. Y., have erected six new buildings during the summer, and are busy on three more. The number of hands employed is 2,298, and when the new buildings shall be finished more will be taken on.

The Bristol, Ky., Pioneer Steel Plant and Rolling-mill Co., which will build two Bessemer and two basic iron furnaces, has been organized with T. H. Spalding, of West Bergens, Pa., president; Justice Cox, Jr., treasurer, and L. B. Stubbs, manager.

The Elliott's Knob Iron, Steel and Coal Company has been incorporated at Staunton, Va., with W. D. Rippeton, president; F. F. Cinniotti, of New York, vice-president, and H. M. Wegner, of Staunton, secretary. The capital stock is $1,000,000.

A small pamphlet has been issued by the Hoggson & Pettis Mfg. Co., New Haven, Conn., in which is described and illustrated the Sweetland lathe chuck and the Porter belt tightener. Matters of interest to all who use lathe chucks or belts will be found in it.

The Wampanoag Mill directors, Fall River, Mass., have contracted for new compound engines of 900 horse-power, cylinders 52x28, to take the place of the engines recently disabled at their plant. It is expected that the new engines will be ready about the middle of October. A new engine-house will also be erected.

Messrs. Aaron J. Palmer, of Amherst, and J. A. Crossman and John A. Laws, of the Enterprise Foundry, Sackville, Canada, have organized themselves under the name and firm of Cumberland Foundry and Machine Works, at Amherst. They intend carrying on a general foundry and machine business, repairing, etc.

An effort is being made to organize in Orangeburg, S. C., a joint stock company, to build and operate a cotton factory, ginnery, grist-mills, with all necessary appurtenances. Capital stock to be $100,000, divided into 400 shares. Location of said factory to be on Cawcaw Creek, at the old Legare mill site, about a mile and a half from the city.

A corporation, to be known as the Boston Welt Machine Co., has been organized at Portland, Me., with a capital stock of $500,000 for the purpose of manufacture and sale of sewing machines. The officers are: President, Rufus H. Woodbury, of Beverly, Mass.; treasurer, Horace A. Roberts, of Lynn, Mass. Certificate approved July 7, 1890.

The Pratt Iron, Coal and Railway Co. has been organized, with William A. Walker, president, and F. D. Nabers, secretary, and purchased the property of the Mary Pratt Furnace Co., at Birmingham, Alabama, including a coke iron furnace, for $500,000. The company is also said to have secured 18,000 acres of coal and mineral lands. The capital stock is $1,000,000.

It is stated that the Jacksonville Mining and Manufacturing Co. has completed negotiations with Eastern and foreign capitalists for the building of large steel works at Tredegar, Alabama, to include rolling-mill, steel-mill, etc., and to employ, when completed, 3,000 men. The company which proposes erecting the plant also intends constructing a system of water-works.

The Union Fiber and Reclaiming Company, of Plainfield, N. J., has been incorporated, for the purpose of manufacturing chemical fiber from wood, straw, cotton and other materials, and reclaiming chemicals used in manufacturing paper. The capital stock is $250,000. Seymour G. Smith and Charles E. Runk, of Plainfield, and P. H. Ralston, of New York, are the incorporators.

The Landon Iron Company, of Salisbury, Conn., has been organized to hold mines and to erect furnace plants for converting minerals into metals; capital stock, $50,000, 500 shares of $100 each; shareholders, Donald T. Warner 1, Albert M. Card, Sharon, 1; F. Kingsbury Curtis, New York, 298; James S. Stearns, Brooklyn, 6.93⅓; W. E. Curtis, New York, 6.93⅓; F. K. Curtis, 6.93⅓; James S. Stearns, Brooklyn, 179.2. Paid in in cash, $38,053.33.

The North American Land Company has been incorporated, at Albany, N. Y., to buy and sell real estate upon commission in all parts of the United States and Canada. The capital of the company is fixed at $100,000, and the principal office is to be in New York. The incorporators are Charles H. Neilson, Allen P. Williams and John Hoop, of New York; Alvah Wiswall, Woburn, Mass.; Joseph E. Stevens, Jr., Minneapolis.

The Pittsburgh Boiler Scale Resolvent Co., of Pittsburgh, have issued a small catalogue of mechanical and technical books, one of these books being sent with each barrel of resolvent for the engineer using it. The books are for the most part recognized as standard authorities on the subjects of which they treat, and we understand that the plan has met with much favor among engineers. The catalogue will be sent to any one interested.

Charles R. Vincent & Co., of New York, have issued the following card: "Mr. Thomas G. Smith Jr., late of Cincinnati, Ohio, has this day been admitted to partnership in our firm. Mr. Smith was formerly identified with the Ball engine in Cincinnati. He is a member of the Society of Mechanical Engineers, and having been with us for some time, is already familiar with the requirements of our business as consulting and contracting engineers."

The Nicholson & Waterman Mfg. Co., of Providence, R. I., have issued a unique pamphlet containing an account of their horizontal boring machine, part one being devoted to an illustrated description of the machine, while part 2 has a number of rough sketches showing some of the operations which can be performed on it. If you are interested, send for it, and when it comes pay no attention to the instructions on the outside wrapper.

A very neatly printed pamphlet comes to hand from The Barnard Engineering Co., of 15 Cortlandt street, New York, describing the Barnard vacuum system for heating buildings by steam "without pressure," by which, of course, is meant pressure below the atmosphere. Any one who contemplates putting in a heating system, or who has one that for any reason is not entirely satisfactory, may examine this pamphlet with the prospect of finding something to his advantage.

The Pittsfield Electric Light Company, Pittsfield, Mass., has been organized, with a capital stock of $100,000, and these officers: President, Alexander Kennedy; treasurer, W. A. Whitlesey; clerk, W. L. Adams; directors, William Stanley, Jr., W. R. Plunkett, C. C. E. Merrill, and the president and treasurer. The company has arranged to buy up both existing companies, thus controlling the electric light system, and will furnish light, power and heat. It will erect a fine new building on McKay street, and equip it with improved machinery.

The Narragansett Machine Works, of Providence, R. I., write us: * * * We have just got started in our new works, which consist of a brick building, 200x50 feet, two stories high, power being furnished by a Corliss engine, heated by Sturtevant hot-air system, and protected from fire by the Grinnell sprinklers. In addition to this there is a lumber shed, with dry kilns 200x20 feet, heated by Sturtevant system, and protected by air-pressure Grinnell sprinklers. We have a switch from the Providence & Boston Railroad, and are in position to do good work.

E. S. Lenox, representing the barbed wire manufacturing firm of Washburn & Moen, of Worcester, Mass., was in Chicago recently, and said in an interview: "I have purchased about sixty acres of ground near the Calumet Iron and Steel Company's works, between One Hundred and Tenth and One Hundred and Fourteenth streets, for a site on which to put up a branch factory for the Washburn & Moen Company. Preliminary work has begun, and I am now going East to arrange the details of the enterprise. The plant will cost $1,000,000, and 1,000 men will possibly be employed."

The Laughlin-Junction steel plant shut down last week for the purpose of making repairs, which, it is estimated, will consume three weeks' time. At the Labelle the only department running is the nail factory, and it will be closed down for repairs as soon as the plate on hand is used up. At the Top mill everything is off except the nail factory and the blast furnace. The factory is working up the available plate as fast as possible. The Wheeling steel plant at Benwood has closed down for the purpose of making repairs. No time will be lost in beginning the work of repairing, and it will be pushed forward as rapidly as possible.—*Wheeling Sunday News-Letter.*

The Sheffield (Ala.) Land, Iron and Coal Company has accepted a proposition from J. G. Chamberlain and associates to erect a rolling-mill, and another from H. B. Tompkins and associates for the erection of pipe works. According to the terms agreed upon, the rolling-mill is to be commenced within sixty days and completed in ten months. The plant is to cost $200,000 and to be 100 tons daily capacity. The land company donates fifteen acres of land, and gives a bonus of $10,000 upon completion of the works. Seventy-five thousand dollars of the stock will be raised by subscription. The pipe works plant is to cost $100,000, and will consume from 100 to 150 tons of iron per day.

The St. Louis Iron and Machine Works has the foundation laid for its new erecting shop, a building to occupy 232 feet by 80 feet, and to be of sufficient height to admit of overhead galleries around the inside of the walls. The new structure, which will be equipped with first-class iron working tools throughout, and provided with a steam crane to travel the entire length, will extend the company's works a distance of 500 feet. The depth of the buildings will be uniformly 80 feet, with a large L for storage and patterns. The full 500 feet will be covered by traveling cranes in the several departments, all in a straight line, so that a casting starting from the foundry could be delivered in the erecting shop, and thence direct to the car.

A Stamford (Conn.) paper of recent date contains a historical sketch of the Yale & Towne Mfg. Co., concluding with the following statement: "At the present time plans are in preparation for a new building east of the present smith shop, to accommodate pulley block and chain making, the building now occupied for these purposes being required for use in connection with the Small Lock Department. *Plans are also under consideration for a large extension of the foundry building.* The number of employes has increased steadily from thirty, in 1869, to over 800 at the present time, exclusive of those employed at the branch houses of the company in New York, Chicago, Philadelphia and Boston."

The Warwick Cycle Company, of Springfield, Conn., is to erect a factory of its own. The business has been increasing rapidly since the reorganization last October, and the company is now badly cramped for room. About 40 men were then employed, while now about 130 are kept busy, and a dozen or more wheels are turned out a day. The present quarters on Hanover street are leased of D. L. Swan and the Springfield Foundry. The directors appointed a committee, consisting of George T. Warwick, the president, George D. Chamberlain, the treasurer, and Edward S. Brewer, vice-president, to secure a location for the proposed factory. It will probably be one of the largest manufacturing buildings in the vicinity.

According to a Utica, N. Y., dispatch, natural gas has been found there in drilling for water. The dispatch says: The gas was found at a depth of 570 feet. The drill had penetrated only slate rock until 555 feet in depth was reached, when Trenton sandstone was found. The gas flows from the well in considerable quantities, and burned throughout the night and to-day very brilliantly. The well is being drilled by an experienced oil driller, who has sunk many wells in this city, several of which pierced through strong gas veins, but the gas has been cased and the drill continued down to water. In the present case it is probable the gas-producing qualities of the rock will be fully tested, as the driller is very positive the territory is good and will furnish gas in paying quantities.

A tract of 5,500 acres in McKean County, near Bradford, Pa., has been purchased by the Steel Tubular Car Company, and upon it will be located the town of Charmony, which it is expected will rival Pullman in car building. This is by far the largest manufacturing enterprise of its kind ever undertaken in Pennsylvania. The capital of the company is $5,000,000, and the officers are: John S. Orr, of New York, president; Col. A. I. Wilcox, vice-president; John W. Post, general manager, and the following board of directors: Henry E. Perrine, Harlon C. Palmer, John G. Valentine, Col. J. A. Marrow, Givon Pike, H. C. Low, M. T. E. Chandler, Col. R. F. Young, H. D. Money and E. John Ellis. Within the next eighteen months the company expect to have the plant completed and their cars running on most of the roads.

The Saranac and Tuscarora, built for the Lehigh Valley Transportation Company by the Globe Iron Works Company, were the first large steamships on the lakes to be fitted with the Worthington independent condensers, built by Henry R. Worthington, N. Y. That they were a success is proven by the Globe giving an order for four more condensers for their four Menominee boats, two of which are now under construction at their yard. This second order from a shipyard that has turned out eleven first-class steamships in twelve months is the highest endorsement of the appliance, which adds in several ways to the completeness of the triple-expansion engine. The Saranac, the first to receive the condenser, has a record of sixteen miles per hour. Half of the last mile, at least, is claimed for the condenser.—*Marine Review.*

The above refers to the independent condensers illustrated in our issue of April 17.

The Pittsfield Electric Company was organized at Pittsfield, Mass., recently, with a capital of $100,000, for the purpose of furnishing electricity for light and power, and for doing a steam-heating business. It has a contract for the purchase of the two existing light companies, the Pittsfield Electric Light Company and the Pittsfield Illuminating Company, with all their machinery, franchises, wires, etc., and purpose uniting these companies in a new station, with new machinery and a first-class plant in every respect. This will be done at once. The officers elected were: President, Alexander Kennedy; treasurer, William A. Whittlesey; clerk, W. L. Adam. The directors are William Stanley, Jr., William R. Plunkett, C. E. Merrill, and the president and treasurer. The new station will be erected at once on McKay street. The company will furnish power for Robbins, Gamwell & Co., and expect to make contracts at once for heating on the west side of North street, including the Insurance Building. The company will have ample facilities for furnishing power for the electric street cars, and will put in their bid at once. With a new and improved electric station, and the prospective additions to the gas works in putting in a water-gas plant, Pittsfield will be better than ever supplied with first-class lighting establishments.—*Weekly Record.*

The report recently published, that J. & W. Seligman & Co. and others had contributed to a large increase in the capital of William Cramp & Sons, the well-known shipbuilders of Philadelphia, was confirmed yesterday by Jesse W. Seligman, who told a *Tribune* reporter that the new capital at the command of the Messrs. Cramp would be about $5,000,000, instead of $3,500,000. Most of his associates in the enterprise, Mr. Seligman said, were Philadelphia steamship men, who would supply some of the new business which the extension of the plant would make possible. "I believe there is a great future for shipbuilding in this country," he added, "and I am going into this matter for a permanent investment, not for a speculation, and so are the others. There are only a few persons interested in the scheme, and it will not be possible to give out particulars before next week, but I can say that the Cramps are to continue their management of the business, and that they are to have another shipyard beside the one now in use." It is said that the Messrs. Cramp have themselves put in a good deal of new capital, and that among the other subscribers are Thomas Dolan, a woolen manufacturer of Philadelphia; Clement A. Griscom, of the Inman & International Steamship Company, and John R. Dos Passos, who is to be general counsel of the reorganized company.—*Tribune.*

Sensational articles have appeared in some of the New York papers in regard to the reorganization of the George F. Blake Manufacturing Company, to the effect that it has been bought out by English capitalists, etc. We find, upon inquiry, that the actual facts in the case are about as follows: Mr. George F. Blake, on account of advanced age, and Mr. E. C. Turner, who has been enfeebled by ill health for several years, have been desirous of withdrawing from the active management of the business for some time past. To extend the company's business in England and on the Continent, it was decided to interest English capital, and the result has been a complete reorganization of the company. The Blake Company have been one of the most successful manufacturers of steam pumps and water-works pumping machinery in this country, and have been in the business for over a quarter of a century. The new company is capitalized at $2,000,000, common stock of which is controlled by the present stockholders of the company, the preferred stock and bonds having been largely taken up by the English interests. In the reorganization of the company Mr. Max Nathan, well known in machinery circles, will take an active interest in the management of the company, together with Mr. George H. Stover, Thomas D. Blake, and the old corps of managers, superintendents and assistants, as heretofore.

Notions and Vagaries Concerning Men and Things Mechanical—Steel Balls.

BY JARNO.

Some persons have vague and erroneous notions as to the weakness of things and the strength of men. There is a notion that a man can smash almost everything when he is mad. Now a mechanic well knows that, without special fixtures or tools, a man cannot smash some things, among which is, for instance, a carpet tack or a spiral spring. I have seen it soberly stated, in a magazine of literary notoriety, that Napoleon was particular as to the sharpness of the scissors with which he trimmed his finger nails. I should not call this a notion, though for a nail-trimmer I prefer a fine file. But the next statement was that dull nail scissors he at once smashed. The placing of such a statement among historical facts is a vagary that did not come from anything that the author ever saw.

Gascon says: "Persons that get their notions of the weakness or of the strength of materials by breaking the necks of champagne bottles, or while mutilating courtesies, may think it easy enough to smash scissors by holding in the hand and striking them on the table; but no person, not even Napoleon, ever did this smashing often enough to form a habit worthy of historical mention. Any one that tries it will find, in so doing, that one's hand is hurt as often as the scissors are injured."

"If you speak often in this strain," said I, "you will get the name of saying sharp things, and people will be chary of talking with you. What does 'mutilating courtesies' have to do with breaking things to pieces?"

He replied: "The one that spends more time in devising ways to keep mechanics at telescopic distances than in learning the facts of machinery, is not likely to be one capable of writing on a mechanical subject. It would be well for some persons to remember that only a genius can write upon any subject, without being acquainted with it, and not write nonsense. In the *Literary World* the reports of recent 'inventions' and 'discoveries' are never read by mechanics, because the reports seldom mean anything, and, when they do, they are so vague that the meaning cannot be ferreted. The reader does not understand the reports, because the writer does not understand the subject. In the AMERICAN MACHINIST, not long since, regarding a magazine writer there was a remark that he must either have been a mechanic, or have taken great pains to inform himself as to the correct use of mechanical terms. This remark contains an important suggestion. The fact that, outside of industrial publications, a correct writer on mechanical subjects is so rare as to be worthy of remark, is a matter of regret. "Taine's History of English Literature" says that the poet Byron follows with a surgeon's exactness all the stages of death; a foot-note says that he had before him a dozen authentic descriptions. This is in the same line as the suggestion in the AMERICAN MACHINIST. Though rather a grotesque subject to work into poetry, yet, so long as Byron had made up his mind to write upon it, he also made sure to write accurately.

"Your friend Norton tells me that he is often puzzled by the remarks of persons in his boarding house. One boarder asked him whether he had seen in the *World* a report of an invention by which thirty horse-power can be got out of a fifteen horse engine by means of gas, etc. The boarder went on with an attempt to repeat the *World's* report, the attempt quite likely being, if possible, more vague than the report. Mr. Norton listened as patiently as he could listen, but he did not understand a word, for the simple reason that the boarder himself could not understand how to do the impossible. Mr. Norton merely asked whether the *World* is a mechanical paper, and remarked that, if it is not, it has probably made a mistake, and he said no more. The boarder was surprised because all the details were not perfectly understood, and attributed Mr. Norton's silence to a lack of mechanical knowledge, or to a disinclination to converse—to anything, in fact, but the real reason. Of course the K. M. comes in for its full share of attention, with much wonder why there are no mechanics to make the perfect machine for the motor."

Gascon's remarks call to mind the fact that many people rely upon the mechanic in some things in connection with his calling, while in other things, rather than follow his advice, they are led away by a pretty story. They rely upon him to build locomotives and printing presses, but when it comes to some scheme to get power out of one end of a machine without putting something into the other end, they believe the story told by a newspaper rather than be guided by long-known principles that can be learned in the mechanical paper.

Gascon continues: "It is also a matter of regret that erroneous notions are found even in a letter coming from the office of a manufacturing establishment. The writer has but to step into the shop, or factory, to obtain his facts; yet I fear that too often he makes up his statements to suit his interest or his wishes, rather than leave his desk. He thinks that, as a matter of course, the facts will correspond to his dictum. There is nothing more certain than that the behavior of materials is not such as will favor the telling of a pretty story, or the notions of a writer as to what should be.

"In the steering-head of my boy's bicycle he found nine balls broken in two. I returned the eighteen half balls to the Mudquill Manufacturing Company, the makers of the bicycle, and asked for whole balls to replace. Nine new ones were sent, accompanied by the following somewhat left-handed acknowledgment of the flaws:

" '*Mr. Edward F. Gascon:*

" 'DEAR SIR—Yours of May 22d at hand. We will send you nine balls without charge. We do not think the balls were defective, but think they were broken on account of the bearing being screwed up too tight. You can easily understand this if you will examine it, that, should the bearing be set up so tight that the balls cannot revolve, the immense leverage would enable the rider to easily break the balls; something must give. We caution you in setting up any ball bearing, that a little pull must be left, so that it will revolve freely. Yours truly,

" 'EGBERT MUDQUILL, President.'

"I did not see how a boy can, in a single bearing in his bicycle, break nine steel balls. As Mr. Mudquill said that I could easily understand it if I would examine, I made experiments, which are illustrated in Figs. 1 and 2. In the first experiment, a new ball, from those sent by Mr. Mudquill, was held between two steel pieces, one lying upon an anvil, while the other was struck with a blacksmith's hammer. After a few blows were struck, the pieces came together as at *A B*, Fig. 1, and into each a half of the ball was sunk. The ball did not break. I had not yet learned how one can be easily broken. The second experiment will be understood by Fig. 2, which shows another of the new balls sunk into two pieces of steel that are held in a vise, one piece resting on the jaw beam at *M*, and the other projecting above the jaws at *C*. With a blacksmith's hammer, several medium blows were struck upon the projecting piece at *C*, to learn whether the ball could be easily sheared in two. The pieces were then taken out of the vise. The ball came out whole. From these experiments I could not understand how a sound steel ball can be either easily broken or easily sheared in two."

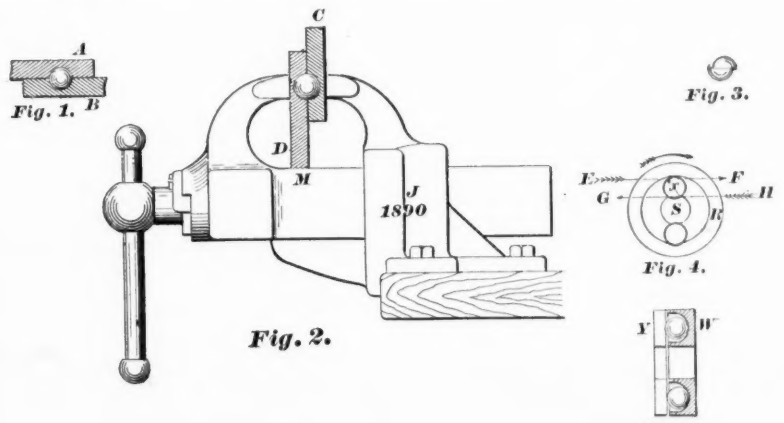

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

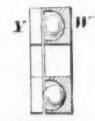

Fig. 5.

"Gascon," said I, "your trials can hardly be called tests. They lack the element of accuracy which I have learned to like so well. A tolerably accurate repetition of your ball-sinking trial, Fig. 1, might be made; but your shearing trial, Fig. 2, is quite indefinite. The piece *C* might be held so tightly in the vise, that, even if the ball were not sunk into it, a 'medium blow' would not move it. Again, your 'medium blow' may be much lighter than another's."

"I well know, Jarno," he replied, "that the experiments have no value as measurements of the strength of steel balls, in pounds, but the units given by Mr. Mudquill were not in pounds. He gave as units, 'easily understand' and 'easily break.' My trials are tests well within the limits of these units. A ball that can be 'easily' broken in a bicycle would certainly break in my trials."

Gascon continues: "Most bicycle balls are made by rolling the stock between dies that give them a circular form in one direction, the rolling or rotation of the stock completing the ball shape. This strains the stock, and sometimes causes a hole or chamber to come in the rolled piece. If the stock ceases to rotate, the sliding of the dies may bring so great a strain upon it as to make one part leave the other, and, instead of a ball, give us a piece shaped something like Fig. 3. The operation may split balls nearly in two, which may not be discovered until after they are put in bearings and we find the half balls.

"Now, just here is where I wish to differ, in fact, where I do differ with Mr. Mudquill. No matter how hard one screws up the bearings, or how often one rides, it is well nigh impossible to split a sound steel ball in a bicycle. Before a hard, sound ball would be split, it would plow grooves into bearings not equally hard. When used under heavy pressure, we might expect a result that will be understood by Fig. 4. Suppose that a ball has sunk into the stationary stud *S*, and into the wheel ring *R* so as to resist the rotation of *R*. Now, if we try to rotate the ring *R*, we shall, at the line *X*, bring a strain that tends to split the ball in two; and, in the direction of the arrows *E F* and *G H*, we shall bring strains that tend to flake. Now, since an arrow section in the figure is so much smaller than the diameter *X*, we should expect the ball to flake rather than to split in two. If the stud and ring are hard enough to resist the sinking that we have supposed in Fig. 4, the action is still more confined to the surface of the ball, giving it a greater tendency to flake.

"In a thrust bearing, Fig. 5, this is what did happen: Pieces flaked off and wedged into the grooved retaining ring *W*, until it was broken, and then the balls fell to the floor. Several were flaked and scored, but not one was split in two. The bearing was repaired, the new balls flaked, and this time broke the washer ring *Y*. None split.

"Now, Mr. Mudquill did not care to learn the facts before writing to me; either this, or he deliberately wrote what he knew not to be true. If he had known that he was writing to a reader of the AMERICAN MACHINIST, he very likely would have written differently. No doubt he believes in the subdivision of labor. The mechanics attend to the shop work, he attends to the office work; they make the machines, he makes the letters. Of course it will not do to have a mechanic know what he writes, and it is beneath his dignity to have one give him any information.

"This method is certainly not that which I saw in the office of one of our largest and best known machine works. An errand boy was sent out into the works; a man came in, dressed in shop clothes, with his sleeves rolled up. The proprietor said, 'Mr. Wilbro, I am not acquainted with this subject, and therefore I will ask you to help me. I think I have written the letter in accordance with what you said, and, if it is correct, I should like to have you sign it.' This method is upon a correct principle. The proprietor does not wish to shift responsibility, but merely to place it where it belongs. So far as I could understand, the letter related to some theoretical question that he did not care to study up. He has enough to do to attend to the management of his business; he can hire others to attend to the theoretical work.

"No letter concerning a material fact, whether it be signed Mudquill Manufacturing Company, or two Mudquill Manufacturing Companies, is any more reliable than the word of the one man that signs it, unless he consult others for his information. If he writes it out of his own thought, it stands or falls in accordance with the quality of his thinking. The letter I received I did not take as coming from the company, but merely from Egbert Mudquill. In business matters he may sign for the whole company, but in mechanical matters he can sign only for himself. Authority may be delegated, but not opinions. The U. S. Congress can decree that the distance between two lines shall be the standard yard, but it takes a mechanic to divide the yard into thirty-six parts, without a remainder, and give us the standard inch."

Since the foregoing conversation, I have seen Mr. Norton, who tells me that, when his fellow-boarders begin to romance on mechanical subjects, he now gives each of them a copy of the AMERICAN MACHINIST. We all know of good places to get shaved. If I wanted my leg sawn off, I would take it to a surgeon. The cure for making such ill-advised assertions as Mr. Mudquill's, and those in the newspapers, is to consult mechanics.

It is well known that it is impossible by ordinary methods to determine the direction of sound in a fog at sea, hence the assumed importance of an instrument called the eophone, the object of which is to enable navigators to do so. The *Times* describes the instrument as follows:

The instrument is a polished black reflector 12 by 18 inches, concave on both sides, with sound receivers in the form of ear trumpets attached to each surface. The eophone is mounted over the deck house on a vertical hollow brass shaft extending through the ceiling. Two tubes connect with the sound receiver, passing through separate resonators and ending with two ear-pieces, one of which produces sound, and the other silence. A series of comprehensive tests was made. It is understood that the instrument gave great satisfaction, and will be favorably reported to the Washington authorities.

The manner in which the position of a vessel in a fog is determined by the eophone is as follows: If the vessel is on one side the sound enters the reflector on that side, while the reflector on the opposite side is silent. By turning a gauge until the sound ceases on the one side it is then heard on the other. By turning the reflector toward the point midway between these two points of silence the sound waves fall upon both ears with equal intensity, whereupon the reflector points directly toward the object heard.

A slight variation of the gauge to break the sound waves enables the operator to follow a moving object in any direction. In this way the position of breakers, spars, icebergs, and other obstacles may be fixed and avoided. In making their tests the board

did not encounter a fog, and so artificial means were resorted to by employing a tug to steam around the Massachusetts, while the board followed her movements from a secluded position in the pilot house, the tug blowing its whistle at intervals. The experiment is pronounced an unqualified success.

Working Aluminum.

The Scoville Mfg. Co., of Waterbury, Conn., give the following directions regarding the working of aluminum:

A cubic inch of pure aluminum weighs approximately one-tenth of a pound avoirdupois, being about one-fourth the weight of an equal bulk of pure silver.

Pure aluminum can be rolled, drawn, spun, stamped, engraved, burnished, polished and soldered to the same extent and by the same processes as used on brass, with the following exceptions:

Annealing.—A very low and even temperature should be maintained in the muffle. Aluminum melts at about 1,300 deg. Fahrenheit—a very dark red. The inexperienced, therefore, cannot judge the proper annealing temperature by the eye alone, without danger of fusing the metal. When the metal has been heated enough to char the end of a pine stick, thus leaving a black mark in the wake of the stick as it is drawn across the metal, it is sufficiently annealed. The metal should then be withdrawn from the furnace and allowed to cool slowly in the air. For some work, such as stamping and drawing, it is sometimes better not to heat the metal so hot as to leave a dead black mark with the stick, but just enough to show a dark brown mark instead. Very thin sheets or wire can be annealed sufficiently for some purposes in boiling water.

Dipping and Pickling.—Remove the grease and dirt by dipping in benzine. To whiten aluminum, leaving on the surface a beautiful white matte, dip first in a strong, hot solution of potash, then rinse in water, and dip in unditluted nitrid acid, 42 deg. Then wash in water, and dry as usual in hot sawdust.

Polishing.—Use fine white polishing composition or rouge, and a rag buff.

Burnishing.—Use a bloodstone or steel burnisher. For hand burnishing use either kerosene oil or a solution composed of two tablespoonfuls of ground borax dissolved in about a quart of hot water, with a few drops of ammonia added.

For lathe work the burnisher should wear upon the finger of his left hand a piece of Canton flannel, keeping it soaked with kerosene, and bringing it in contact with the metal, supplying a constant lubricant.

Very fine effects can be produced by first burnishing or polishing the metal and then stamping it in polished dies showing unpolished figures in relief.

Scratch Brushing.—Polish or burnish the surface and then use a fine steel scratch brush.

Soldering.—A special solder is necessary. Cleanse the metal from grease and dirt. Use for soldering, fluid Venetian turpentine. Place the solder upon the metal with the Venetian turpentine and heat gently in a blow pipe until the solder is melted. It will then be found to have fixed itself firmly to the aluminum.

Sand Castings.—Use open but very fine sand, and bake the mould. Large feeding grates should be provided, and the mould should be well vented. Pour the metal quickly at a temperature but little above the melting point. Use either Taylor's or Dixon's plumbago crucibles.

Milling, Planing, and Turning.—Use plenty of oil to prevent the clogging of the tool and to make it cut smooth.

Boiler Compounds.

At the various meetings of railroad men where the subject of the purification of feed water was under consideration of late months, there has been a decided tendency displayed to discredit the value of any compound offered for neutralizing the pernicious effects that feed water impurities usually produce on locomotive boilers. There are few lines of business run by practical men where more worthless nostrums have been tried than in the doctoring of feed water, with the result that there is now a strong inclination among those interested to regard all chemical remedies for bad water as productions of fraudulent quackery. There is good ground for believing that this wholesale way of disposing of all remedial agencies not only inflicts injustice upon those offering really meritorious compounds, but it prevents railroad companies from receiving the benefit conferred by mixtures that neutralize to some extent the injurious action that bad feed water exerts upon heating surfaces.

It does not always follow that things which have been successfully applied to stationary boilers will work satisfactorily with locomotives, but when a feed-water medicine acts in a stationary boiler to prevent the formation of scale the chances are that similar treatment would do good service with locomotive boilers if modified to suit the changed conditions. Papers have repeatedly been submitted to the American Society of Mechanical Engineers, describing the beneficial effects that resulted from the use of kerosene in steam boilers, and there is no room for doubting that the oil named is a valuable preventive of incrustation. At last meeting of the society Mr. R. C. Carpenter described experience with kerosene on boilers at Lansing, Mich. [This paper was published in the AMERICAN MACHINIST of June 5]. Badly scaled boilers were relieved of the incrustation through the use of kerosene, and then a small quantity administered regularly prevented the formation of new scale and caused the lime salts deposited by the feed water to remain in the shape of mud, which was readily blown out. There were about 20 grains of solid matter in each gallon of the feed water.

Kerosene may not be the petroleum compound best adapted for use in locomotive boilers, but the experience with it indicates that, with a little care, some such ingredient might be used in locomotive boilers in a way that would materially reduce the expense for boiler repairs. We have heard the objection raised to the use of petroleum compounds, that they released the scale in large pieces, which choked up the openings between the flues and the water legs. If the oil has this effect on an incrusted boiler it ought to be used with success in keeping boilers newly out of the shop free from scale. Prevention is always better than cure, and what is badly wanted on many railroads is a disposition to persevere in treatment that will make cure unnecessary.—*National Car and Locomotive Builder.*

Machinists' Supplies and Iron.

NEW YORK, July 19, 1890.

Iron—American Pig—There have been no new developments since last week. Orders being filled are absorbing current production for all the better known brands, and little or no anxiety seems to be felt for the future by sellers.

We quote Northern No. 1 Foundry, $18 to $18.50; No. 2, $16 to $17. Southern No. 1, $17 to $17.50; No. 1, Soft, $16.50 to $16.75; and No. 2, $16 to $16.25.

Scotch Pig—The demand has been moderate. We quote Eglinton, $18 to $18.75; Dalmellington, $20.50 to $21; Coltness, $23.50 to $24.

Bar—The demand has been fairly good, and the market firm.

We quote Common, $1.85; Medium, $1.90; Refined, $1.95 to $2 for round lots on dock.

Copper—The market has ruled quiet and firm. The Lake mining companies have fixed their prices at 17c., but some supplies are still to be had from outside sources at 16½c. to 16¾c. Casting brands are held at 14½c., Arizona, 15½c.

Lead—The market has ruled dull, but firm. No sales of importance having been made.

We quote for near delivery 4.55c. to 4.57c.

Spelter—The demand has been moderate, but sellers have been firm.

We quote ordinary brands of Western, 5.45c. to 5.60c. Choice, 5.70c. to 5.75c. Refined, 6.75c. to 7c. Silesian, 7¼c. to 7½c.

Tin—Values have undergone no change here, though there has been some rise in London. Values range from 20.75c. to 21c.

Antimony—The demand for Regulus has been moderate, and the market has been steady.

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"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Lathe and vise men; steady work, good wages. The Charter Gas Engine Co., Sterling, Ills.

Wanted—Good die sinker. P. O. Box 316, Buffalo, N. Y.

Wanted—Two first-class pattern makers on marine engine work. Address Box 46, AM. MACH.

Wanted—First-class vise hands. Gisholt Machine Co., Madison, Wis.

Mechanical draftsman wants a situation. Y., care of AMERICAN MACHINIST.

Wanted—Situation as foreman of pattern shop, by a practical man; good ref. Box 45, AM. MACH.

Experienced mechanical draftsman, with shop prac. and tech. ed., wishes sit. Box 49, AM. MACH.

Wanted—A good, sober, reliable man, who is accustomed to running a Bement & Miles boring-mill. The Stiles & Parker Press Co., Middletown, Conn.

Wanted—Situation by first-class molder, on loam, dry sand or green; capable of taking charge of shop. Box 44, AMERICAN MACHINIST.

Wanted—By a young man (31), position as traveling salesman for a machine or hardware company, on commission or salary. Address A., AM. MACH.

Wanted—A foreman, to take charge of the forging department of bolt and nut works. Address, giving age, experience, salary expected, Bolts, AM. MACH.

Wanted—A foreman for blacksmith and hammer dept's, Pittsburgh, Loco. Works. Must be temperate and thoroughly understand the business. State wages exp'd, and address the Company.

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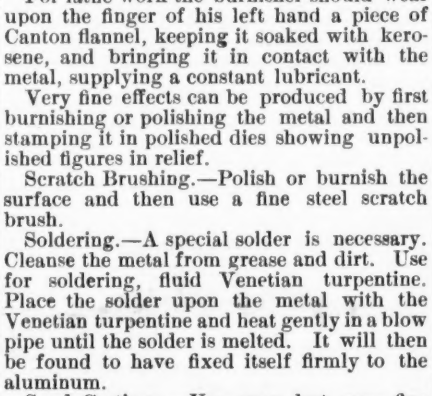

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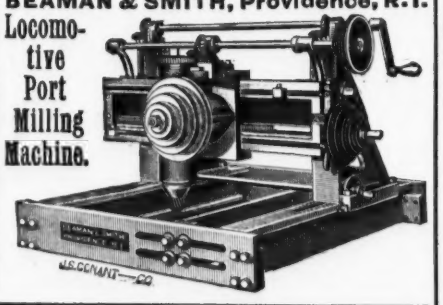

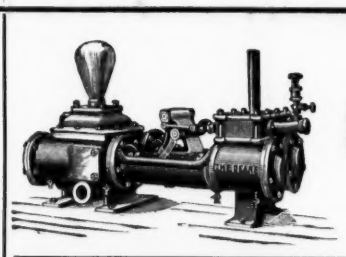

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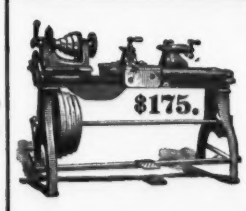

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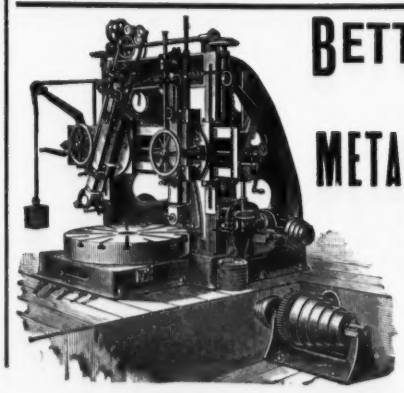

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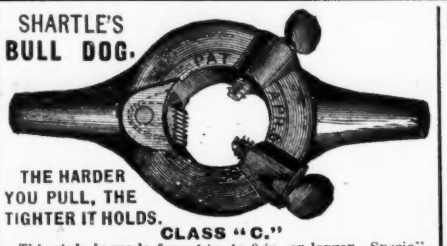

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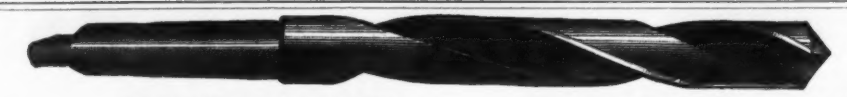

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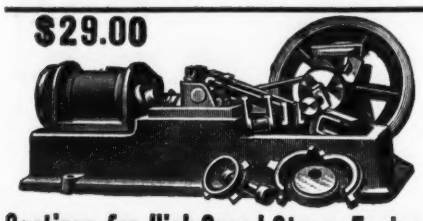

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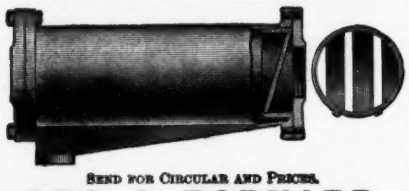

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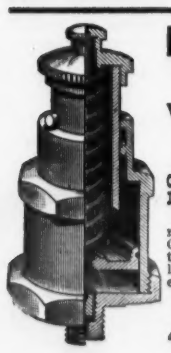

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Foundry Practice, Various Articles on. By Robt. E. Masters, appearing in 16 issues.
Strength of Different Mixtures of Cast-iron and Method of Testing. By Robt E. Masters, April 24.
Foundry Practice, Articles on. By Foundryman. [L. C. Jewett.] Aug. 14, Sept. 25, Dec 18.
Foundry Practice, Articles on. By S. Bolland, May 8, 22 29, June 26. July 10.
The Morton-Poole Roll Grinding Lathe. By Joshua Rose, J. G. Tramis, Geo. H Babcock and C. A. Smith. July 3, 24, Aug. 7, 14, 21, Sept. 25.
Machine Shop Cost and Time Accounts. By A. J. Shaw, Henry Metcalfe and C. A. Burton, April 3, 17, May 8.
Tests of Iron. By David Spence, April 17, Oct. 30
Traction on Grades. By A. B. Ropes, Oct. 30.
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Self-contained Engines. By W. H. Hoffman, Feb. 27, Mar. 6.
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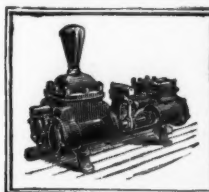

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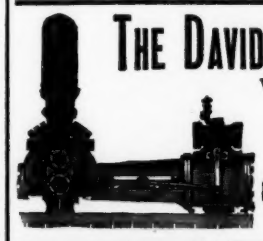

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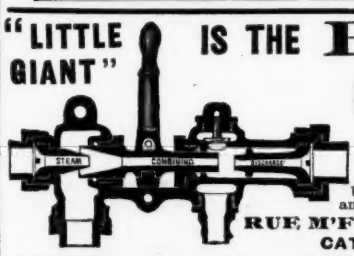

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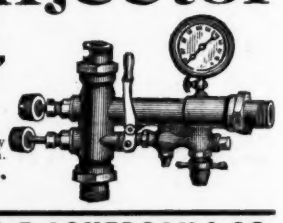

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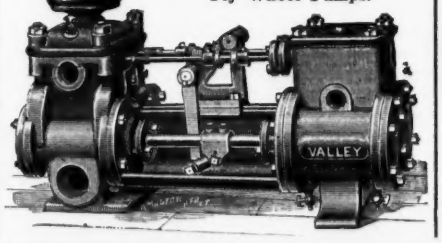

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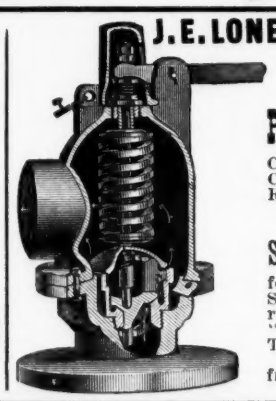

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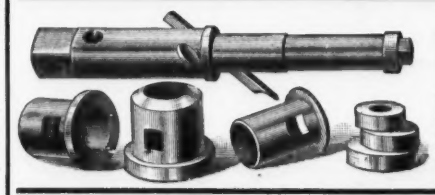

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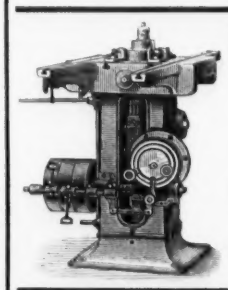

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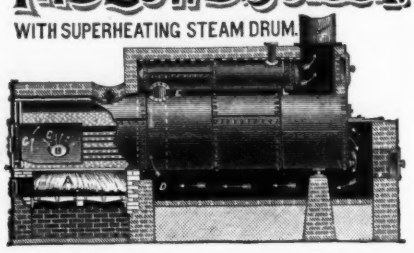

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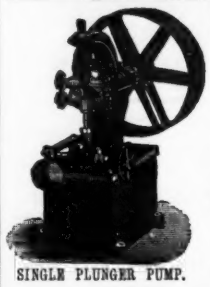

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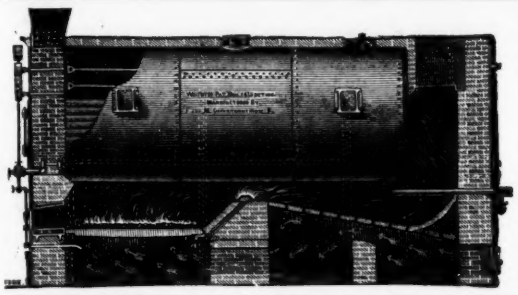

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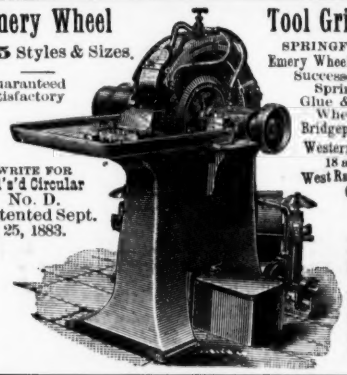

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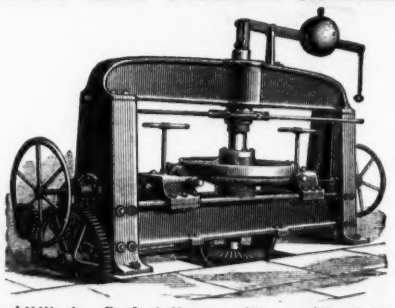

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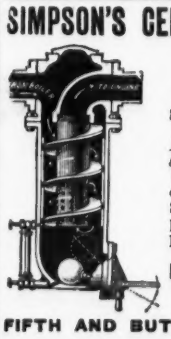

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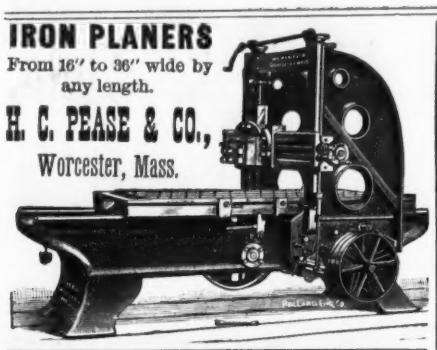

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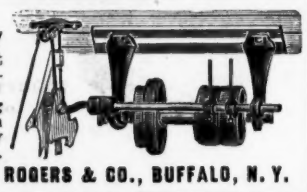

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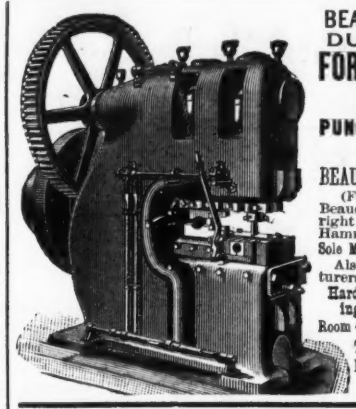

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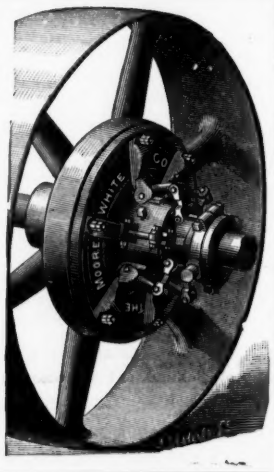

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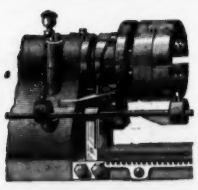

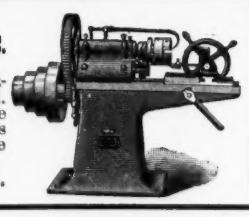

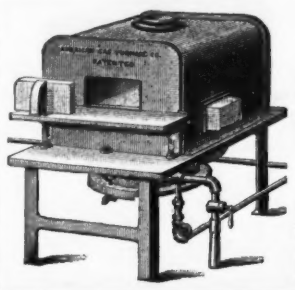

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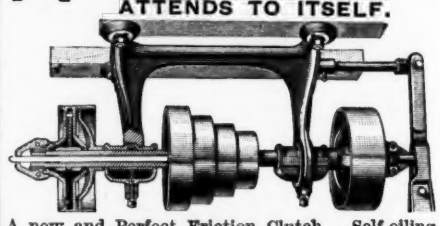

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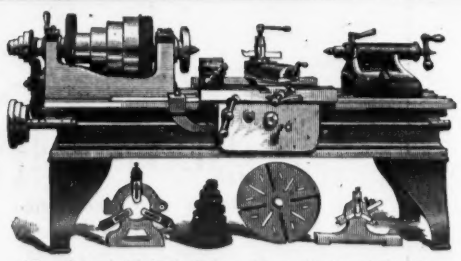

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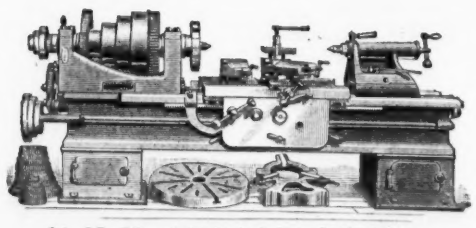

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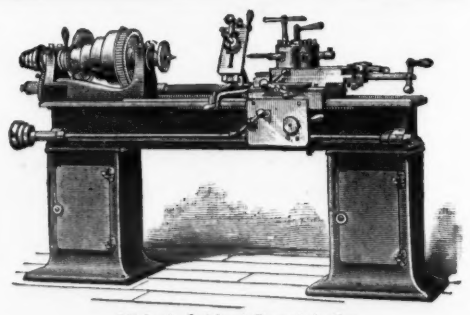

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Taper Attachment, Automatic Feed, Lever and Screw Movement, most complete brass lathe on the market.
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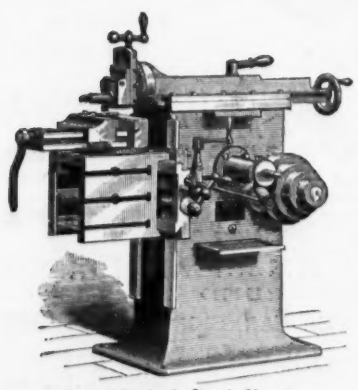

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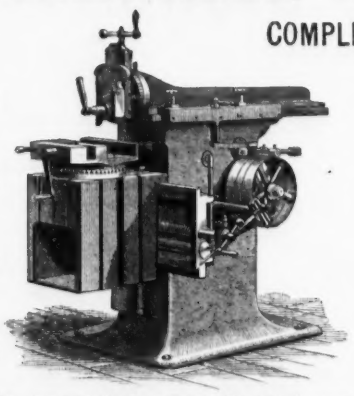

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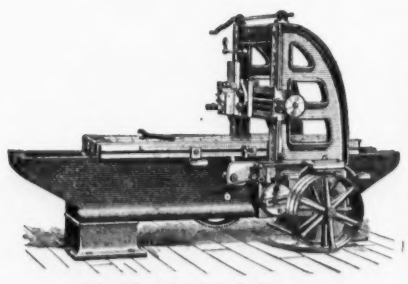

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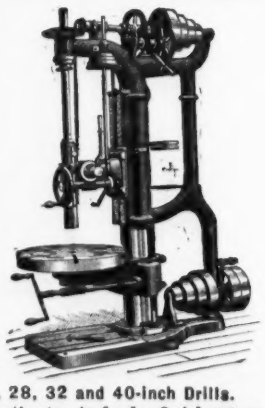

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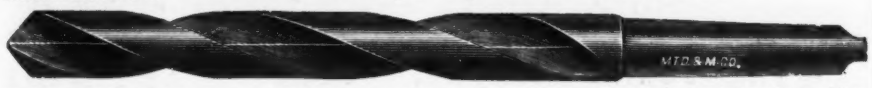

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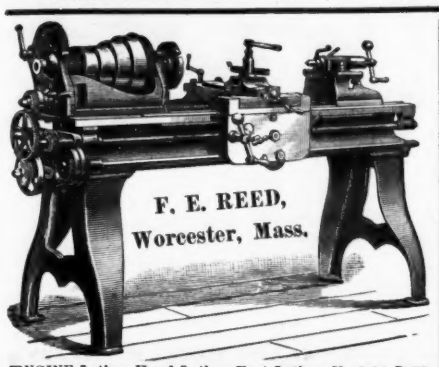

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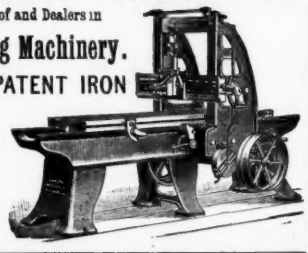

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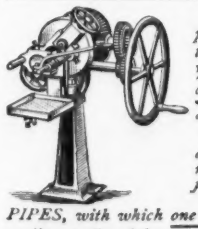

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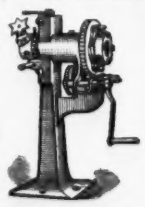

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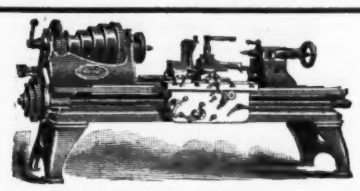

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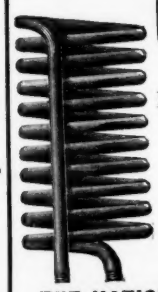

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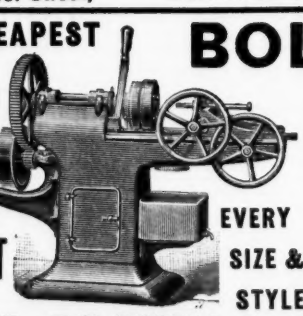

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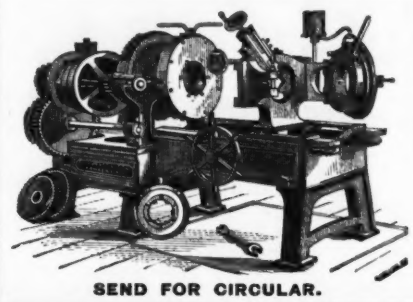

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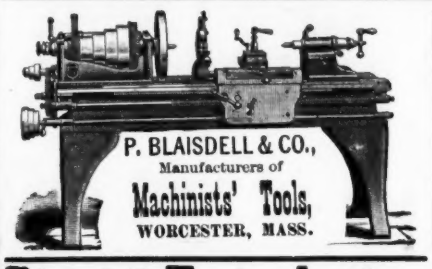

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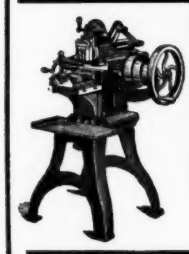

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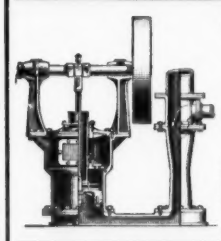

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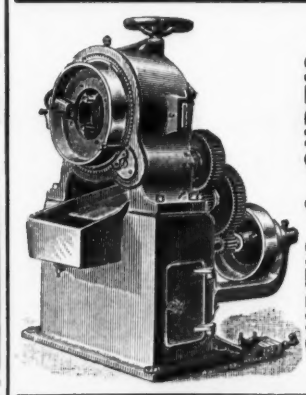

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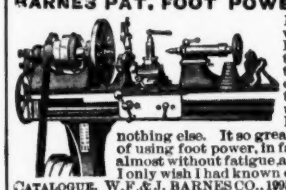

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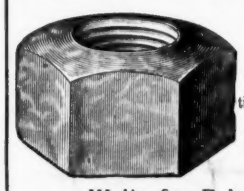

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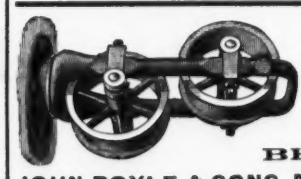

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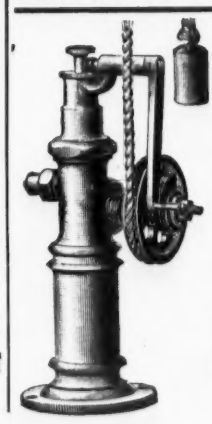

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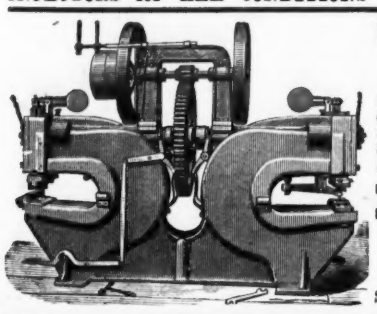

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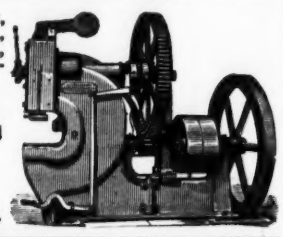

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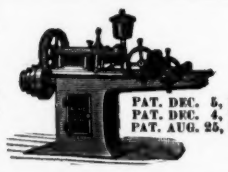

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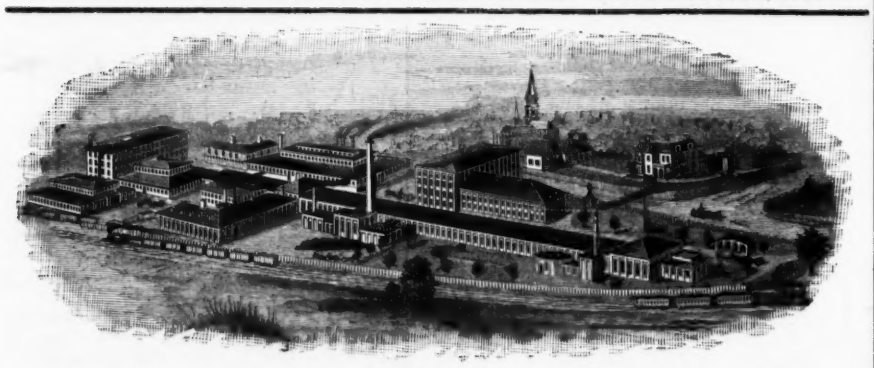

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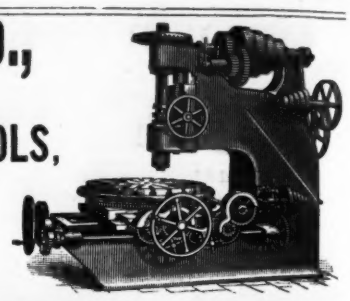

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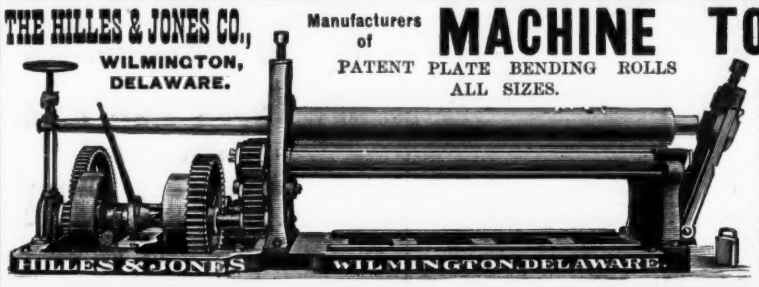

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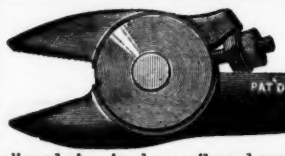
☞ We will replace in Stock or Mutual Companies any Insurance canceled on account of using this System, when installed according to our plans.



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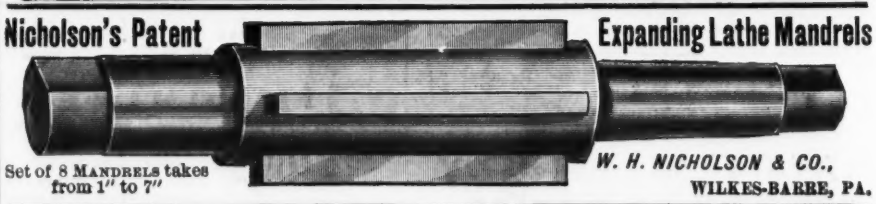

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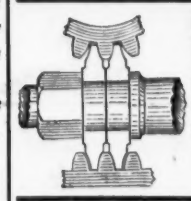

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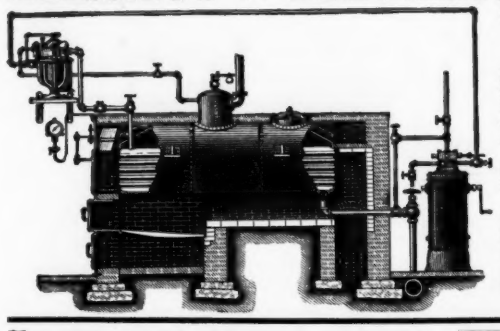

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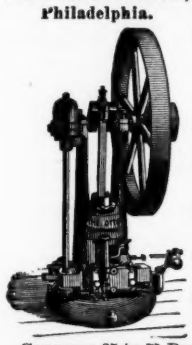

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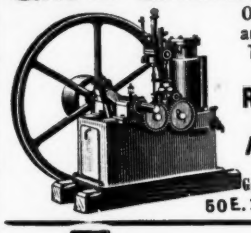

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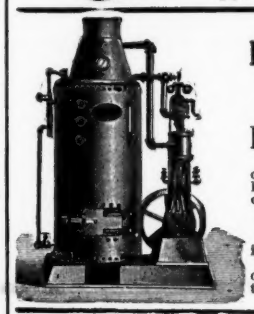

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" "	16 in. x 8 ft	McMahon,	"
" "	16 in. x 6 ft.	Lathe & Morse 9 in. chuck	fitted good order
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" "	18 in. x 8 ft.	Prentice,	"
" "	18 in. x 8 ft.	New Haven,	fair
" "	20 in. x 10 ft., with Taper, Compound Rest and Turret,	Bridgeport,	good as new
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"	24 in. x 24 in. x 6 ft.	Fitchburg,	"
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"	14in. " Trav. head,	Fitchburg,	new
"	16 in. stroke, Eberhardt's Pat.,		"
"	17 in. "	Wright,	"
"	24 in. "	Hendey,	good order
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"	21 in. Back geared,	"	"
"	24 in. " " Self-feed,	F. S.	"
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Brown & Sharpe, No. 1 Universal Miller,			good as new
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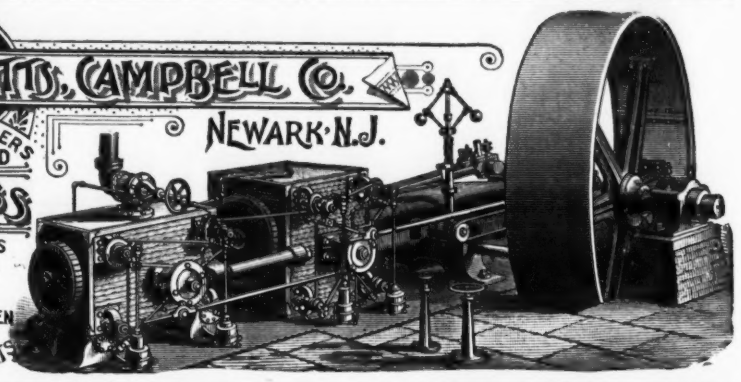

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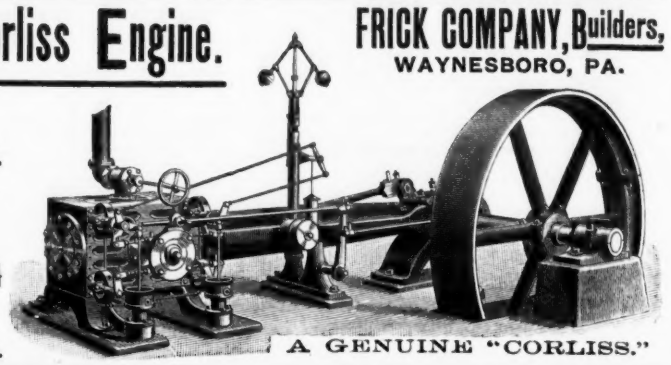

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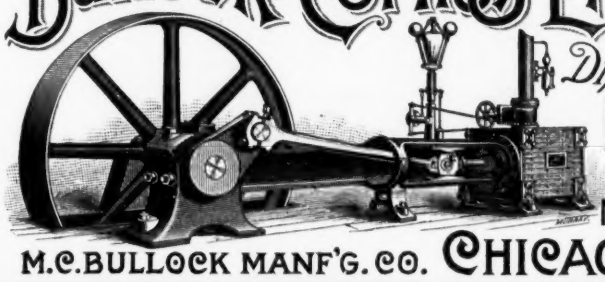

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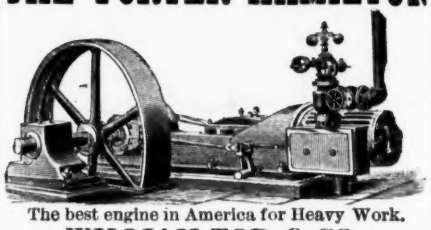

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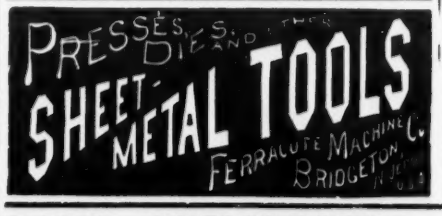

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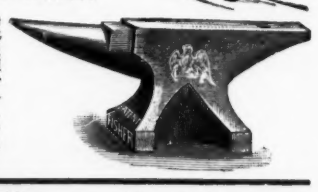

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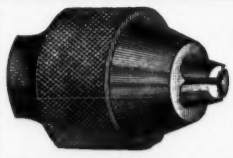

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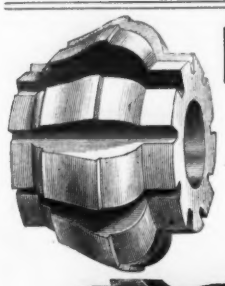

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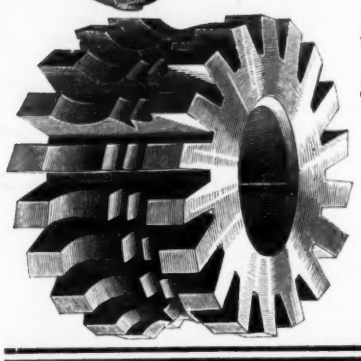

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Also, Standard Oil Co., Lima, O.; Morgan Engineering Co., Alliance, O.; Grand Trunk Railway of Canada, Montreal, Can.; Brainard Milling Machine Co., Hyde Park, Mass.; Boston Bridge Works, Boston, Mass.; Pond Machine Tool Co., Plainfield, N. J.; Niles Tool Wks., Hamilton, O.; Geo. A. Gray Co., Cincinnati, O. Write to

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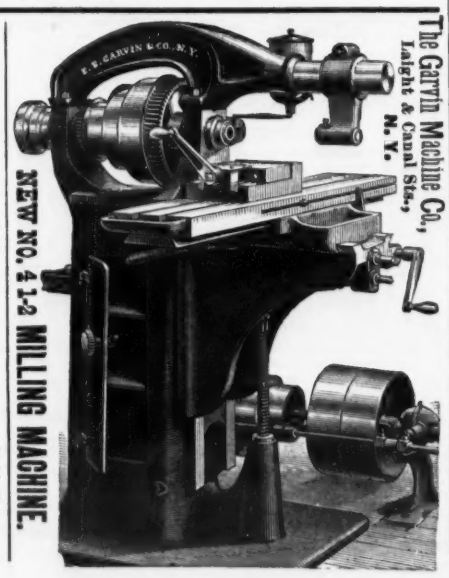
For Catalogue A. NEWARK, N. J.



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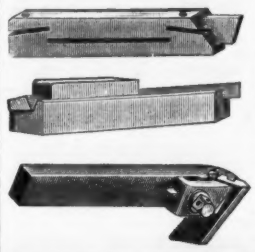

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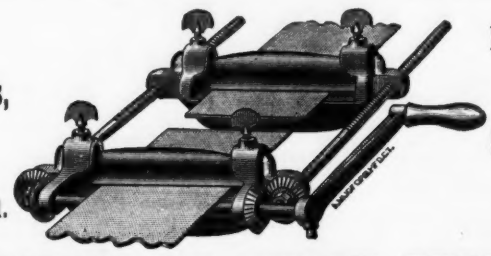

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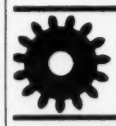

Every machine or manufacturing concern should send for the list of 600 sizes of cut iron spur and bevel gear wheels and racks lately issued by the Lexington Gear Works, of Lexington, Mass.
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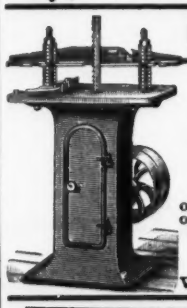

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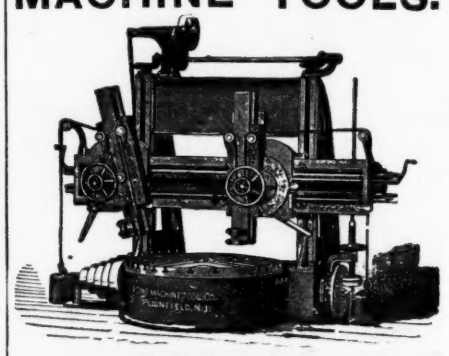

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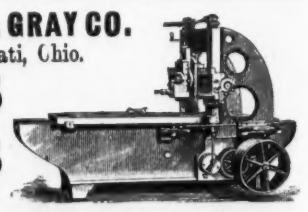

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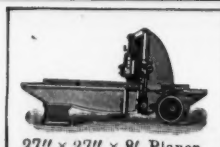
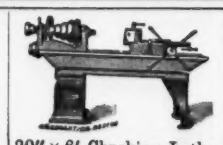
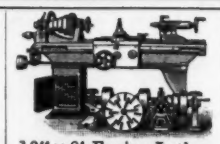


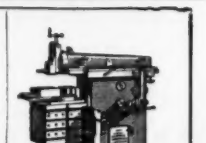
27" × 27" × 8' Planer.



20" × 6' Chucking Lathe.



16" × 6' Engine Lathe.



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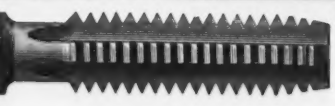

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